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An Evaluative Study of the Navy Medical Department's Patient Classification and Staffing Allocation System

(The Workload Management System for Nursing)

Final Report

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AN EVALUATIVE STUDY OF THE NAVY MEDICAL DEPARTMENT PATIENT CLASSIFICATION AND STAFFING ALLOCATION SYSTEM

(The Workload Management System for Nursing)

Final Report

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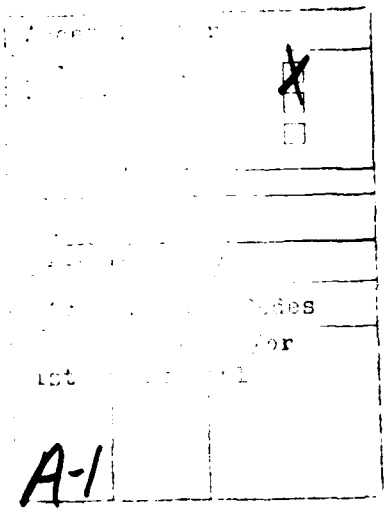

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TABLE OF CONTENTS

SECTION **Page**

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

STUDY: An Evaluative Study of the Navy Medical Department's Patient Classification and Staffing Allocation System (The Workload Management System for Nursing) Final Report - Research Report 5-85

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PURPOSE: The purpose of this study was to evaluate the validity and reliability of the Workload Management System for Nursing (WMSN) which includes a patient classification system and staffing methodology. The system is currently being used in 36 naval hospitals. In addition, the perceptions of registered nurses regarding the usefulness of the system as a management tool were measured using written questionnaires.

POPULATION: The WMSN was tested at six hospitals selected to provide a representative mix of CONUS facilities by size, geographic location, nursing unit configuration, and population served. Additional selection criteria included the availability of up-to-date monthly nurse staffing information and inter-rater reliability testing reports for a minimum of four months.

METHOD OF DATA COLLECTION: At each study site approximately 20% of the inpatient census (n = 229) was randomly selected from the ICU, CCU, Peds, Nursery, and Medical-Surgical units for reliability testing. (The Psych tool which was under development during this study was not included.) The patients selected for inclusion in the study were classified using the Patient Classification Critical Indicator tool by both the investigator and by a registered nurse assigned to the unit. The classifications were completed independently within two hours of each other. To evaluate staffing adequacy, charge nurses completed a questionnaire at the end of each shift for a three day period. To evaluate perceptions of the quality of direct and indirect care given during the three day test period, charge nurses and staff nurses completed a Nursing Care Evaluation Form. A demographic questionnaire to characterize the respondents and obtain feedback on perceptions of strengths, weaknesses, and usefulness of the system was also obtained.

In addition, congruent validity of the Patient Classification tool was determined during a parallel study conducted by the Army at five Medical Treatment Facilities. Using the Nursing Care Hours Standards (NCHS) tool developed by the Army, which had content related and criterion related validity, selected patients were classified by Army investigators using both tools. To ensure utility of the findings, the Navy and Army investigators established their inter-rater reliability with the WMSN Patient Classification tool prior to initiating data collection.

METHOD OF ANALYSIS: For inter-rater reliability, an agreement level of 80 percent was set as the minimally acceptable criterion. Agreement was sought between categories and between factors. The relationship between category scores was tested using the Kappa Statistic. Analysis of variance Intra-Class Correlation (ICC) was used to demonstrate agreement within factors. Validity was established by testing the relationship between the WMSN classification and the NCHS classification tools using the Pearson Product Moment (PPM) Correlation. Descriptive statistics were used to determine level of user acceptability and perceptions of system strength and weaknesses. Analysis of variance and Scheffe comparisons were used to compare charge nurses' perceptions of staffing adequacy and perceptions of quality care given under various staffing conditions for 452 shifts. The same analyses were used to ascertain the relationship between staffing conditions and the performance of direct and indirect care activities.

FINDINGS: The inter-rater reliability agreement level for the six hospitals was 85 percent. To rule out consistent variation, the Kappa Statistic was calculated and found to be .78. Category agreement was significant at the $p < .01$ level. Within specialty units category agreements were: ICU/CC = 94%, Medicine = 76%, Nursery = 96%, Pediatrics = 84%, Post-Partum = 88%, and Surgery = 88% with all Kappa Statistics significant at $p < .01$. Inter-rater reliability within factors on the Patient Classification Critical Indicators Instrument was calculated using the ICC. Findings for all factors were above .90 except for the emotional support, complex treatments, teaching, and simple treatments factors. All correlations were significant at $p < .01$. The PPM correlation between the Army's NCHS tool and the WMSN patient classification tool based on a random sample of 141 patients was .81 (Army, 1984).

Of 434 nurse respondents, 78.6% were staff nurses, 12.2% were charge nurses, and 9.2% were supervisors. Of this sample 81.7% worked in two large hospitals. The WMSN system was rated as "moderately" to "very easy" to use by 90.4%, was perceived as being "usually" or "always" accurate by 50.7%, and as "useful" or "very useful" by 49% of the sample; 74% were "neutral" to "very satisfied" with the system. Of the nurses responding to the satisfaction questions, 81% indicated that they had not seen the daily summary sheets or monthly staffing graphs. (Thus, their perceptions were based solely on the patient acuity portion of the system.) Perceptions of satisfaction varied significantly for those who had and those who had not been involved in staffing decisions ($F = 29.07$, $p < .01$).

Usefulness as a management tool and ease of use were identified as the major strengths of the system. Major weaknesses were inaccuracy in reflecting workload, lack of comprehensiveness, and lack of reliability from staff member to staff member. Of those respondents who expressed dissatisfaction with the accuracy and comprehensiveness of the system, most worked in the L&D or psychiatric specialty areas. Given a choice, 51% of the staff nurses, 82% of the charge nurses, and 88% of the supervisory nurses would continue to use the present system. These responses were positively correlated with having seen the WMSN staffing summary sheets and graphs. Over half of the respondents stated that it takes less than two minutes to

classify a patient. Ninety-five percent prefer to classify only once a day, and that classification is to be on the day shift (83%).

Shift staffing adequacy was obtained from charge nurses' subjective reports. Across the hospitals, 87 out of 452 or 19.2% of the shifts were identified as being staffed poorly or less than adequately. Factors influencing staffing patterns consisted of greater than usual number of patients requiring either extensive nursing care time (22.6%) or special treatments or procedures (18.8%), and less than adequate number of staff on duty (19.2%). When asked what would have helped, 90.8% of the charge nurses indicated that additional staff was needed, with 45% citing that an additional nurse would have solved the problem. Charge nurses' perceptions of quality of care provided and perceptions of staffing adequacy were significantly correlated ($r(452) = .71$, $p < .01$).

To evaluate the relationship between actual staffing and charge nurses' perceptions of staffing adequacy and perceptions of quality of care given during the 452 shifts, a Workload Index was created using recommended staffing as determined by the WMSN. The means for perceptions of staffing adequacy and perceptions of quality of care provided were compared to the Workload Index (+2 staff, $\pm$1 staff, and -2 staff levels) using the Scheffe method. Results of the multiple comparisons revealed significant ($p<.05$) differences between the three staffing levels for charge nurses' perceptions of how adequately a unit was staffed and for perceptions of the quality of care provided. In addition, significant positive linear relationships were found between the Workload Index and perceptions of quality care ($r = .28$, $p < .01$) and staffing adequacy ($r = .24$, $p < .01$).

Charge nurses ($n = 468$) and staff nurses ($n = 464$) evaluated the quality of direct and indirect care provided on each shift using a Nursing Care Evaluation Questionnaire. The internal consistency (Cronbach's Alpha) for both subscales on this questionnaire was .98. Perceptions of quality care provided differed between the two groups for vital signs ($F = 5.91$, $p < .01$) and for administrative duties ($F = 4.67$, $p < .03$). In each case, staff nurses evaluated the care given as better than the charge nurses. Two components of direct care judged as being provided less than adequately by both groups were teaching (17%) and emotional support (21%). Indirect care activities judged as completed less than adequately by a large percentage of nurses were: a) initiating and updating the patient care plans (40%); b) performing administrative duties (33%); c) making rounds with physicians (39%); d) allowing for personal time to include meals and breaks (28%); and e) orienting new personnel (24%).

To ascertain the relationship between actual staffing levels and perceptions of how "well" direct and indirect care activities were performed, registered nurse staffing on 452 shifts was categorized into three levels using the Workload Index criteria. Results of an ANOVA to compare the composite direct and indirect care subscales mean values revealed significant differences in the values ($p < .01$) across all Index levels. To determine if the mean values of the individual nursing factors (groups of activities) within the subscales differed based on the Workload Index, separate analyses were conducted. For both direct care and indirect

care activities, the mean values differed significantly. Multiple mean comparisons revealed that all means for the factors in both subscales were different ($p < .05$) except for feeding, which differed only if the RN staff was below recommended (-2 or more).

CONCLUSIONS: Study results indicated that the Workload Management System for Nursing patient acuity tool is both valid (as measured by the NCHS tool) and reliable. Factors identified as having a low intra-class correlation will be made explicit to hospitals, so that appropriate teaching and monitoring regarding documentation can be ensured. Nurses perceived the system as useful for management purposes, and, in general, were satisfied with the system. This perception of satisfaction was significantly affected by whether the nurse was involved with entire system or only the patient classification portion, and by the specialty unit on which the subjects worked.

Charge Nurses' perceptions of quality of care given and staffing adequacy were significantly related to staffing levels as defined by the WMSN. A significant finding was the relationship between actual staffing (as defined by the Workload Index) and nurses' perceptions of how well direct and indirect nursing care were provided. Although classification systems have been judged as extremely effective in matching workload to numbers of staff, the linkage between quantity of nursing personnel to quality of outcome has been elusive. The results of this study demonstrate that quality, as defined by perceptions of how "well" nursing care was provided, is linearly related to the numbers of staff available to give that care on a nursing unit. Therefore, these results give some credence to the assumptions that quantity and category of staff (i.e., RN) are directly related to quality of care provided.

Though the Workload Index revealed that only 13% of the 452 shifts were understaffed by -2 personnel or more, several indirect care activities were judged as completed inadequately by a large percentage of respondents. A parallel study conducted by Misener and Freline (1983) reported that, across nine Army hospitals, average time spent by direct nursing care providers was distributed as 28.5% for direct care, 56.5% for indirect care and 15% as unavailable for patient care. These percentages were validated during the re-analysis of a study conducted by Kelly (1980) in three naval hospitals and results reported for the civilian community (Lake, 1982). The tested WMSN system did not include unavailable time and allocated only 45-65% of staff time for indirect care depending upon hospital type and room configuration. A requirements model predicated on the current WMSN percentages does not appear to give adequate time for indirect care functions. Based on these findings, the percentages allotted to direct care, indirect care, and unavailable time for patient care by specialty area were realigned and incorporated into the current system.

RECOMMENDATIONS: As a result of the study, recommendations were made for: ongoing validity and reliability assessments; extending computerization of the system to all hospitals; development of a mark-sense version of the patient classification tool; and extending the system to cover the measurement of patient care requirements in Labor and Delivery, Recovery Room, and Ambulatory Care.

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AUTHORS

Commander Karen A. Rieder, NC, USN, is principal investigator and project direction for this study. During the conduct of this study, CDR Rieder was Director, Research Department, Naval School of Health Sciences, Bethesda, Maryland.

Commander Susan Jackson conducted the study to meet the requirements of HSA 270: Research in Health Services Administration, under the direction of Dr. R. F. Southby, Ph.D., in partial fulfillment of the requirements for a Post-Masters Graduate Certificate in Health Services Administration from The George Washington University, Washington, DC.

An Evaluative Study of the Navy Medical Department's Patient Classification and Staffing Allocation System (The Workload Management System for Nursing) Final Report

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1. INTRODUCTION AND PURPOSE.

The purpose of this study was to evaluate the validity and reliability of the Workload Management System for Nursing (WMSN) which had been under development since 1981. In addition, the perceptions of registered nurses regarding the usefulness of the system as a management tool were measured using written questionnaires. A preliminary report published in August 1984 presented the background information for the study, including the hypotheses, literature review, instrumentation, and analysis of the results from the first test site (Rieder & Jackson, 1984). This final report summarizes and analyzes the data from the six naval hospitals included in the study. To simplify the reading and interpretation of the results, the definition of terms and hypotheses will be repeated in this report.

2. DEFINITION OF TERMS.

Workload Management System for Nursing: a systematic process for determining staffing requirements based upon identified patient care needs. The system includes a patient classification tool and a staffing methodology. The patient classification instrument is of factor evaluative design and

requires that a registered nurse assess ten factors related to direct patient care and assign a score to each factor. The assessment consists of both retrospective and prospective components; that is, assessment of care received and required during the day shift is used to predict care requirements for the next 24 hours. The weighted factor scores are summed resulting in the patient being classified into one of six discrete categories. The staffing methodology is designed to determine the actual nursing care hours required for a specified group of patients and the numbers and mix of personnel recommended to provide quality care. This system incorporates both direct and indirect care time.

Patient classification: the grouping of patients according to an assessment of their nursing care requirements over a specified period of time.

Critical Indicators: those nursing activities on the patient classification instrument that have the greatest impact on direct care time.

Factors: a group of critical indicators that cover one specific domain of activities. They include ten areas: vital signs, monitoring, activities of daily living, feeding, simple treatments/procedures/medications, complex treatments/procedures/medications, respiratory therapy, IV therapy, teaching, and emotional support.

Points: the values assigned to each specific critical indicator based upon documented time and motion studies. Each point is equal to 7½ minutes of direct nursing care time.

Category: the representative grouping of patients according to their nursing care requirements. The Workload Management System consists of six categories. A Category I patient requires minimal care whereas a Category VI

patient requires intensive care, that is, more than one staff member to one patient relationship.

Direct Nursing Care Time: the activities that take place in the presence of the patient and/or family. These activities are observable, behavioral, and include the following: placement of equipment at bedside, explanation of procedure to patient, preparation of patient, performance of treatment, removal of equipment from area, recording of treatment at bedside, assessment/observation of patient response, and teaching.

Indirect Nursing Care Time: those activities, conditions, and circumstances that necessitate time over and above direct care. To address these factors, indirect care time and special allowances have been incorporated into the nursing care hour requirements for each of the six patient care categories. During this evaluative study, an indirect care time percentage ranging from 45 to 75 percent was built into the nursing care hour requirements for each category. The percentages were distributed as follows: indirect care plus unpredicted needs - 45%, teaching hospital allowance - 10%, and semi-private room allowance - 20%.

Nursing Care Hour Requirements: the hours of nursing care time required for each category of patient based upon an assessment of their direct and indirect nursing care needs. This is operationalized via six pre-calculated nursing care hour requirement charts which incorporate two factors: type of unit (open, semi-private room, nursery, or light care) and type of facility (teaching vs. non-teaching hospital).

Personnel Requirements: the number and mix of RNs (Registered Nurses) and NRNs (Non-Registered Nurses) required to care for the patient workload on

a unit. This is operationalized via two charts: acute care and intensive care. The acute care chart allocates a 40% RN to 60% NRN personnel mix and distributes 45% of staff to the day shift, 35% to the evening shift, and 20% to the night shift. In contrast, the intensive care chart utilizes a 60% RN to 40% NRN personnel mix which is evenly distributed across all shifts.

RN: a professional Registered Nurse who has satisfactorily completed an orientation program to the hospital.

NRN: nursing personnel other than RNs who have satisfactorily completed an orientation program to the hospital. These include Hospital Corps personnel, LPNs, and ward clerks.

Workload Index: a comparison between the actual nursing staff on a unit and the number recommended by the WMSN based upon patient requirements. For this study the index levels were defined as less than recommended (-2 staff or more), at recommended ($\pm$1 staff), and greater than recommended (+2 staff or more).

Trained Rater: a nurse (RN) who has undergone standardized training in the use of the patient classification instrument.

Inter-Rater Reliability: level of agreement (in factors and in categories) achieved when two trained raters independently assess a group of patients on a specified unit during the same time period using the patient classification instrument. An 80% agreement level is required.

Intra-Service Reliability: level of agreement in factors and in categories within each clinical service (medicine, surgery, pediatrics, ICU/CCU, nursery, and post-partum) when trained raters independently classify patients using the patient classification instrument. An 80% agreement level is required.

3. METHODOLOGY.

a. Hypotheses. In order to determine the validity and reliability of the WMSN for quantifying inpatient care workload and for establishing manpower requirements, the following hypotheses were tested:

1. The WMSN patient classification tool will have high (80% agreement) inter-rater reliability for patient category at each test facility.
2. The WMSN patient classification tool will have high (80% agreement) intra-service reliability for patient category on like specialty nursing units across the test facilities.
3. The WMSN patient classification tool will exhibit high internal consistency within its factors.
4. Validity of the WMSN Patient Classification tool will be established by a high correlation with the Nursing Care Hours Standards instrument which possesses content and criterion-based validity.
5. Nurses will express more satisfaction than dissatisfaction with the WMSN.
6. There will be a positive, significant relationship between charge nurses' perceptions of staffing adequacy and quality of care given and the Workload Index.
7. There will be a positive, significant relationship between charge and staff nurses' perceptions of how well direct and indirect care activities were provided to patients and the Workload Index.

b. Setting and Selection Criteria. Over a six month period, the WMSN was evaluated at six study sites selected to provide a representative mix of CONUS naval hospitals by bed size, geographical location, nursing unit configuration, and mission to population served. Additional criteria included the availability of up-to-date monthly nurse staffing summary information and reports of inter-rater reliability testing using the patient classification instruments for a minimum of four months. The six naval hospitals included in the study were: 1) two small hospitals - NH Cherry Point and NH Lemoore; 2) two medium hospitals - NH Charleston and NH Camp Pendleton; and 3) two large teaching hospitals - NH Oakland and NH Portsmouth.

A detailed review of the procedure, copies of the data collection instruments, and a description of the statistical tests performed can be found in the preliminary report.

c. Instruments. At the six study sites approximately 20% of the inpatient census (n = 229) on 35 nursing units were randomly selected from ICU/CCU, pediatrics, nursery, post-partum, medical, and surgical units for reliability testing. The patient sample was classified using the Patient Classification Critical Indicator Instrument by both the investigator (nurse expert) and a registered nurse classifier on each nursing unit.

Validity of the Patient Classification tool was determined during a parallel study conducted by the Army at five Medical Treatment Facilities (Norton, 1984). Selected patients were classified by Army investigators using both the WMSN Patient Classification tool and the Army Nursing Care Hours Standards (NCHS) tool, which had established content and criterion-related validity (Sherrod, Rauch, & Twist, 1981). To ensure

generalizability of the findings, the Navy and Army investigators established their inter-rater reliability with the WMSN Patient Classification tool prior to initiating data collection.

To characterize the respondents and to obtain feedback on perceptions of the strengths, weaknesses, and usefulness of the WMSN, a demographic questionnaire was completed by all participants. To measure perceptions of staffing adequacy and perceptions of the quality of nursing care given, charge nurses on all shifts over a three day period (n = 452) completed the Unit Staffing Evaluation Questionnaire. These subjective findings were then correlated with the actual number and mix of personnel assigned to the ward and the recommended number and mix of staff proposed by the WMSN system.

Lastly, all nurses (charge and staff) were requested to indicate their perceptions of how well direct nursing care was given and indirect nursing tasks were completed on each of nine shifts. These perceptions were obtained through administration of the Nursing Care Evaluation Questionnaire. To ascertain if perceptions differed based on role, the responses of the charge nurses (n = 468) and staff nurses (n = 464) were compared.

d. Method of Analysis. For inter-rater reliability, an agreement level of 80 percent was set as the minimally acceptable criterion. Agreement was sought between the six patient categories and between the ten critical indicator factors. The relationship between category scores was tested using the Kappa Statistic. An analysis of variance (ANOVA) intra-class correlation (ICC) approach was selected to examine rater agreement within the factors (Ventura, Hageman, Slakler, & Fox, 1980). Congruent validity was established by testing the relationship between the WMSN Classification and the NCHS Classification tools using the Pearson Product Moment (PPM) Correlation.

Descriptive statistics were used to determine the level of user acceptability and perceptions of system strengths and weaknesses. Analysis of variance and Scheffe comparisons were used to compare the charge nurses' perceptions of staffing adequacy and perceptions of quality of care given under various staffing conditions for 452 shifts. The same analyses were performed to ascertain the relationship between staffing conditions and the performance of direct and indirect nursing care activities.

4. PRESENTATION AND ANALYSIS OF DATA.

a. Description of Subjects. The study sample consisted of 434 registered nurses from six naval hospitals. The group was comprised of 78 males (18%) and 356 females (82%) with 56 percent being under 34 years of age. By nursing position 78.6% were staff nurses, 12.2% were charge nurses, and 9.2% were supervisors, administrators, and educators. Of this sample, 81.7% worked in the two large teaching hospitals. All nurses were familiar with the Navy Workload Management System, but 12% indicated that they did not classify patients on a regular basis. A demographic profile of participants from each naval hospital is presented in Appendices A1-F1.

Using the hypotheses as a framework, the following results were obtained from the study data.

b. Composite Findings on the Reliability of the Workload Management System For Nursing. A comparison of the patient category agreement (n = 229) between the nurse expert and charge nurse classifiers for 35 nursing units at six naval hospitals is presented in Table 1. The inter-rater reliability category agreement across six hospitals was 85 percent. To rule out consistent variation, a Kappa Statistic was calculated and found to be .78

TABLE 1

PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS ACROSS SIX NAVAL HOSPITALS

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	CHARGE NURSES RATING: Category 1	Category 2	Category 3	Category 4	Category 5	TOTAL
Category 1		42	9	0	0	0	51
		18.34	3.93	0.00	0.00	0.00	22.27
		82.35	17.65	0.00	0.00	0.00	
		93.33	9.18	0.00	0.00	0.00	
Category 2		3	85	15	0	0	103
		1.31	37.12	6.55	0.00	0.00	44.98
		2.91	82.52	14.56	0.00	0.00	
		6.67	86.73	22.73	0.00	0.00	
Category 3		0	4	51	2	0	57
		0.00	1.75	22.27	0.87	0.00	24.89
		0.00	7.02	89.47	3.51	0.00	
		0.00	4.08	77.27	14.29	0.00	
Category 4		0	0	0	12	1	13
		0.00	0.00	0.00	5.24	0.44	5.68
		0.00	0.00	0.00	92.31	7.69	
		0.00	0.00	0.00	85.71	16.67	
Category 5		0	0	0	0	5	5
		0.00	0.00	0.00	0.00	2.18	2.18
		0.00	0.00	0.00	0.00	100.00	
		0.00	0.00	0.00	0.00	83.33	
TOTAL		45	98	66	14	6	229
		19.65	42.79	28.82	6.11	2.62	100.00

Percent of Agreement = 195/229 or 85.15%
Kappa Statistic = .784
Standard Deviation of Kappa = .034
Z Score = 22.9609
Category agreement significant at $p < .001$ using Kappa Statistic.

which was significant at $p < .001$ level. Table 2 summarizes the agreement levels and Kappa Statistics for each study hospital. A breakdown of the reliability results by category for the individual study sites can be found in Appendices A2-F2.

To compare the reliability of the WMSN across specialty services, percent agreement and Kappa Statistics were analyzed for the nursery, pediatric, post-partum, critical care, medical, and surgical units (Table 3). The highest level of agreement (96%) occurred in the nursery units and the lowest (76%) in the medical units with Kappa Statistic significant ($p < .001$) for all specialty areas. Detailed tables of category classification agreement between the nurse expert and charge nurses for each specialty service can be found in Appendices G1-G6.

c. Composite Findings on the Reliability (Internal Consistency) of the Factors Within the Patient Classification Instrument. Internal consistency within the ten factors of the patient classification tool was analyzed using the Intra-class Correlation Coefficient (ICC). ICC was chosen to estimate inter-rater reliability in order to rule out the possibility of consistent variation between raters. As shown in Table 4, findings were above .90 for all factors except: emotional support (.50), complex treatments (.58), teaching (.74), and simple treatments (.74). All correlations were significant at $p < .001$. The ICC for total factor scores was .96. The ICC findings for individual study hospitals are presented in Appendices A3-F3.

d. Validity of the WMSN Patient Classification Instrument. Professional nursing judgment was a key factor in the design of the Navy patient classification tool. Critical indicators were selected based on input from

TABLE 2

INTER-RATER RELIABILITY FOR PATIENT
CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT
AND CHARGE NURSES FOR SIX NAVAL HOSPITALS

Hospital Name	Agreement Level	Kappa Statistic
Camp Pendleton	88%	.83
Charleston	89%	.84
Cherry Point	89%	.82
Lemoore	94%	.86
Oakland	79%	.69
Portsmouth	81%	.71
All six hospitals	85%	.78

ALL Kappa Statistics significant at $p < .001$ level

TABLE 3

SUMMARY OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS FOR SPECIALTY SERVICES ACROSS SIX NAVAL HOSPITALS

Specialty Area		Percent of Agreement	Kappa Statistic
Nursery	(n=26)	96%	.93
Post-Partum	(n=33)	88%	.80
Pediatric	(n=25)	84%	.74
ICU/CCU	(n=18)	94%	.92
Surgical	(n=52)	88%	.88
Medical	(n=75)	76%	.62

n = number of patients classified in a specialty service.

ALL Kappa Statistics significant at $p < .001$.

TABLE 4

INTER-RATER RELIABILITIES FOR CRITICAL INDICATOR FACTORS
AS ESTIMATED BY ICC ACROSS SIX NAVAL HOSPITALS

Factor	Intra-Class Correlation (ICC)
Vital Signs	.946
Monitoring	.967
Activities of Daily Living	.953
Feeding	.939
Simple Treatments	.742
Complex Treatments	.580
Respiratory Therapy	.917
Intravenous Therapy	.927
Teaching	.744
Emotional Support	.502
Continuous Care	---
TOTAL POINTS	.964

staff, charge, and supervisory nurses at 33 hospitals. As each new version of the instrument was developed, its prima facie validity was established by clinical experts from various specialty services prior to testing.

Specific nursing care time assigned to each activity was based upon the results of the four year time and motion study conducted by the Army (Sherrod, et al., 1981). During this comprehensive Nursing Care Hour Standards (NCHS) study, patient classification instruments for six specialty areas were constructed. Content validity was ensured by input of professional nurses during the design and validation phases of tool development. Validity of the classification tool for predicting actual nursing requirements was established during two independent testing periods. The correlation coefficients for the relationship between documented direct nursing care requirements and the patient classification instruments ranged from $r = .98$ to $r = .99$. Criterion-related validity was established using observational studies to determine the relationship between actual, timed direct nursing care activities and the instruments. The criterion-related validity coefficients ranged from $r = .87$ to $r = .99$ (Sherrod, 1985).

Although the Navy had incorporated the Army's mean times for nursing activities into its classification tool, the two systems had been developed independently. Nursing activities were identified specific to each military service, and the Navy patient classification tool delineated indicators for emotional support and patient teaching. To establish validity of the WMSN classification tool, 10% of the patients ($n = 141$) at five Army hospitals were randomly selected and independently classified by two investigators. One investigator classified patients using the WMSN tool while the other rated the same patients with the Army's NCHS classification tool. To

decrease response bias, the two investigators alternated the tool used. The Pearson Product Moment correlation between the NCHS tool and the WMSN Patient Classification tool was .81. When the data was adjusted for the emotional support factor which had no equivalent in the Army tool, the correlation increased to .89 (Norton, 1984).

e. Nurses' Perceptions of Acceptability and Satisfaction With the Workload Management System For Nursing. Perceptions of satisfaction with the WMSN were obtained using information from the Staff Questionnaire (n = 434). Perceptions surveyed included ease of use, accuracy, usefulness, and major strengths and weaknesses of the system. Data was analyzed using variables such as hospital size, nursing position of the respondent, and whether or not nurses had seen the monthly graphs and daily staffing summary reports. No significant differences were found between responses based upon the size of the facility in which the nurses worked. However, there were significant differences among respondents' perceptions of accuracy of the system in reflecting level of care required, usefulness as a management tool, and satisfaction with the WMSN based upon nursing position and whether or not the nurse had reviewed the monthly staffing graphs and daily staffing summary sheets.

The WMSN was rated as "moderately easy" to "very easy" to use by 90.4% of the nurses, was perceived as being "usually" or "always" accurate by 50.7%, and as being "useful" or "very useful" by 49%. A breakdown by nursing position showed that 44% of the staff nurses, 72.6% of the charge nurses, and 81% of the supervisory level nurses viewed the WMSN as "usually" accurate (Table 5). This same pattern emerged for perceptions of usefulness. An analysis by nursing position showed that 40.2% of staff nurses, 76.5% of

TABLE 5

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING PATIENT CARE REQUIREMENTS BY NURSING POSITION ACROSS SIX NAVAL HOSPITALS

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN: USUALLY	SOMETIMES	NEVER	TOTAL
STAFF NURSE		147	177	10	334
		44.01	52.99	2.99	
		68.69	89.85	90.91	
CHARGE NURSE		37	13	1	51
		72.55	25.49	1.96	
		17.29	6.60	9.09	
SUPERVISORY		30	7	0	37
		81.08	18.92	0.00	
		14.02	3.55	0.00	
TOTAL		214	197	11	422

n = 422

Missing Cases = 12

Chi-Square = 29.586

Degrees of Freedom = 4

Probability = .0001

charge nurses, and 87.5% of supervisory level nurses found the WMSN "useful" (Table 6).

Overall satisfaction with the system was lower with 36.4% of the nurses being "very satisfied" or "satisfied" and 38% selecting "neutral". Again, there was significant variation in perceptions when the data was analyzed by nursing position and whether or not the monthly staffing graphs and daily staffing summary sheets had been reviewed. In Table 7 the analysis by nursing position revealed a significant pattern in which only 28% of the staff nurses were "satisfied" with the system in contrast to 73.7% of the supervisory level nurses who expressed satisfaction. Perceptions of accuracy, usefulness and satisfaction with the WMSN at each individual test site can be found in Appendices A4-F4, A5-F5, A6-F6.

A closer analysis of the data revealed that in four test sites 81% of the respondents, which included 96% of those who were dissatisfied ($n = 70$), had never reviewed the Daily Staffing Sheets and Monthly Staffing Graphs (Table 8). Their perceptions were based solely upon the classification portion of the WMSN. Of the staff nurses in the study, 92.3% ($n = 240$) had not been privy to staffing information. This group comprised the majority (89.7%) of those whose perceptions of system usefulness were based only on the classification phase of the system (Table 9). The difference in perceptions based upon exposure to the staffing portion of the WMSN is compared in Tables 10 and 11. Perceptions of satisfaction varied significantly for nurses who had and had not been involved in staffing decisions ($F = 29.07$, $p < .0001$).

The major strengths of the system identified by the respondents were: 1) "usefulness as a management tool"; 2) "ease of use"; and 3) "takes minimal

TABLE 6

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL
BY NURSING POSITION ACROSS SIX NAVAL HOSPITALS

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		133	124	74	331
		40.18	37.46	22.36	
		64.25	89.86	96.10	
CHARGE NURSE		39	10	2	51
		76.47	19.61	3.92	
		18.84	7.25	2.60	
SUPERVISORY		35	4	1	40
		87.50	10.00	2.50	
		16.91	2.90	1.30	
TOTAL		207	138	77	422

n = 22

Missing Cases = 12

Chi-Square = 50.688

Degrees of Freedom = 4

Probability = .0001

TABLE 7

SATISFACTION WITH THE WMSN BY NURSING POSITION
ACROSS SIX NAVAL HOSPITALS

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH THE WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		93	140	95	328
		28.35	42.68	28.96	
		61.18	88.05	88.79	
CHARGE NURSE		31	12	9	52
		59.62	23.08	17.31	
		20.39	7.55	8.41	
SUPERVISORY		28	7	3	38
		73.68	18.42	7.89	
		18.42	4.40	2.80	
TOTAL		152	159	107	418

n = 18

Missing Cases = 16

Chi-Sqaure = 44.338

Degrees of Freedom = 4

Probability = .0001

TABLE 8

SATISFACTION WITH THE WMSN BASED ON WHETHER NURSES HAD REVIEWED OR HAD NOT REVIEWED THE MONTHLY STAFFING REPORTS AND GRAPHS ACROSS SIX NAVAL HOSPITALS

SATISFACTION WITH WMSN	FREQUENCY / ROW PCT / COL PCT	SAW MONTHLY REPORTS: NO	SAW MONTHLY REPORTS: YES	TOTAL
SATISFIED		73	35	108
		67.59	32.41	
		29.67	60.34	
NEUTRAL		106	20	126
		84.13	15.87	
		43.09	34.48	
DISSATISFIED		67	3	70
		95.71	4.29	
		27.24	5.17	
TOTAL		246	58	304

Results based on data from four of six study sites.

Chi-Square = 23.188

Degrees of Freedom = 2

Probability = .0001

TABLE 9

COMPARISON OF NURSES WHO REVIEWED OR DID NOT REVIEW MONTHLY WMSN REPORTS BY NURSING POSITION

Nursing Position	Saw Staffing Reports/Graphs		
Frequency Row Pct Col Pct	Saw Reports	Did Not See Reports	TOTAL
Staff Nurse	19 7.72% 32.20%	227 92.28% 89.72%	246
Charge Nurse	19 52.78% 32.20%	17 47.22% 6.72%	36
Supervisory	21 70% 35.60%	7 30% 3.56%	30
TOTAL	59	253	312

Results based on data from four of six hospital sites.

TABLE 10

SATISFACTION WITH WMSN AMONG NURSES WHO REVIEWED MONTHLY SUMMARY REPORTS AND GRAPHS BY NURSING POSITION ACROSS SIX NAVAL HOSPITALS

Controlling Variable: Reviewed Reports and Graphs

NURSING POSITION

FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN			TOTAL
	SATISFIED	NEUTRAL	DISSATISFIED	
STAFF NURSE	8	11	0	19
	42.11	57.89	0.00	
	22.86	55.00	0.00	
CHARGE NURSE	11	6	2	19
	57.89	31.58	10.53	
	31.43	30.00	66.67	
SUPERVISORY	16	3	1	20
	80.00	15.00	5.00	
	45.71	15.00	33.33	
TOTAL	35	20	3	58

Data from four of six hospital sites.

TABLE 11

SATISFACTION WITH WMSN AMONG NURSES WHO HAD NOT REVIEWED MONTHLY SUMMARY REPORTS AND GRAPHS BY NURSING POSITION ACROSS SIX NAVAL HOSPITALS

Controlling Variable: Did Not Review Reports and Graphs

NURSING POSITION	SATISFACTION WITH WMSN			
FREQUENCY / ROW PCT / COL PCT	SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE	59	100	62	221
	26.70	45.25	28.05	
	80.82	94.34	92.54	
CHARGE NURSE	9	3	5	17
	52.94	17.65	29.41	
	12.33	2.83	7.46	
SUPERVISORY	5	3	0	8
	62.50	37.50	0.00	
	6.85	2.83	0.00	
TOTAL	73	106	67	246

Data from four of six hospital sites.

time to complete" (Table 12). In analyzing the selected strengths by nursing position, there was a significant difference between the three roles for usefulness of the system as a management tool. This response was selected by 33% of the staff nurses, 60.4% of the charge nurses, and 65% of the supervisory level nurses (Table 13). The major weaknesses of the system were identified as: 1) "inaccuracy in reflecting workload"; 2) "lack of comprehensiveness"; and 3) "lack of reliability from staff member to staff member" (Table 14). An analysis of weaknesses by nursing position revealed no significant differences. However, a review of written comments on the questionnaire indicated that the greatest degree of dissatisfaction was expressed by nurses in the labor and delivery, newborn nursery, and ICU/CCU specialty areas. For a list of strengths and weaknesses by individual hospitals, see Appendices A7-F7 and A8-F8.

Despite the weaknesses identified, given a choice, 51% of the staff nurses, 82% of the charge nurses, and 88% of the supervisory nurses would continue to use the present system. Choice of responses was significantly correlated with whether or not participants had seen the WMSN staffing summary sheets and graphs. Over half of the respondents stated that it takes less than two minutes to classify a patient. Ninety-five percent of the respondents preferred to classify only once a day. Nurses working on units where patient care requirements fluctuated dramatically between shifts, such as the critical care units, requested an option to classify more frequently. The day shift was the preferred time for classifying patients according to 83% of the respondents.

f. Correlation Between Charge Nurses' Perceptions of the Quality of Nursing Care Given, Staffing Adequacy, and Recommended Staffing Using the Workload Index. Perceptions of staffing adequacy and quality of nursing care

TABLE 12

RANK ORDER OF MAJOR STRENGTHS* OF THE WMSN
AS PERCEIVED BY NURSES ACROSS SIX NAVAL HOSPITALS

Variable	Agreement	
	Frequency	Percent
Usefulness as Management Tool	170	39.2
Ease of Use	120	27.6
Takes Minimal Time To Complete	91	21.0
Reliable	72	16.6
Comprehensive	68	15.7
Accurately Reflects Workload	59	13.6
No Strengths Noted	65	15.0

n = 434 nurses

*More than one response could be selected.

TABLE 13

PERCEPTIONS THAT USEFULNESS AS A MANAGEMENT TOOL
WAS A MAJOR STRENGTH OF THE WMSN
BY NURSING POSITON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	STRENGTH - USEFUL AS A MANAGEMENT TOOL: NOT CHECKED	CHECKED	TOTAL
STAFF NURSE		229	112	341
		67.16	32.84	
		86.74	65.88	
CHARGE NURSE		21	32	53
		39.62	60.38	
		7.95	18.82	
SUPERVISORY		14	26	40
		35.00	65.00	
		5.30	15.29	
TOTAL		264	170	434

Chi-Square = 26.931

Degrees of Freedom = 2

Probability = .0001

TABLE 14

RANK ORDER OF MAJOR WEAKNESSES* OF THE WMSN AS PERCEIVED BY NURSES ACROSS SIX NAVAL HOSPITALS

Variable	Agreement	
	Frequency	Percent
Inaccurate in Reflecting Workload	159	36.6
Not Comprehensive	139	32.0
Unreliable	134	30.9
Takes Long Time To Do	106	24.4
Not Useful As A Management Tool	45	10.4
Difficult To Use	19	4.4
No Weaknesses Found	22	5.1

n = 434 nurses

*More than one response could be selected.

given were obtained from charge nurses (n = 452) who completed the Unit Staffing Evaluation Questionnaire at the end of each shift for three consecutive days. In general, factors identified as influencing staffing patterns were: 1) greater than usual number of patients requiring either extensive nursing care time (22.6%) or special treatments or procedures (18.9%), and 2) less than adequate number of staff on duty for 87 out of 452 shifts (19.2%). When asked what would have helped to improve staffing levels on the 87 understaffed shifts, 90.8% of the charge nurses indicated that additional staff was needed, with 46% specifically requesting one additional RN to solve the problem. In responding to the single item question about the quality of nursing care provided on the shift, charge nurses perceived that only on 25 of 452 shifts (5.5%) was less than adequate care given. For the 87 shifts perceived as understaffed, quality of care provided was identified as less than adequate 24% of the time. Charge nurses' perceptions of quality of care and staffing adequacy were significantly correlated with perceptions of staffing adequacy ($r=.71$, $p < .0001$).

An objective measurement of the hospitals' staffing patterns was obtained using a Workload Index. Results of a 1983 pilot study at two large naval hospitals suggested that nurses' perceptions of the quality of care provided varied significantly when a nursing unit was understaffed by two or more persons. To test this hypothesis, the numbers of RN, NRN, and total staff assigned to each unit at the study sites were taken from the Workload Management Daily Staffing Summary Sheets. A Workload Index of three levels (greater than recommended staffing, at recommended staffing, and less than recommended staffing) was developed for each shift using the continuum from plus two to minus two persons. Out of 544 shifts, 74 shifts were identified

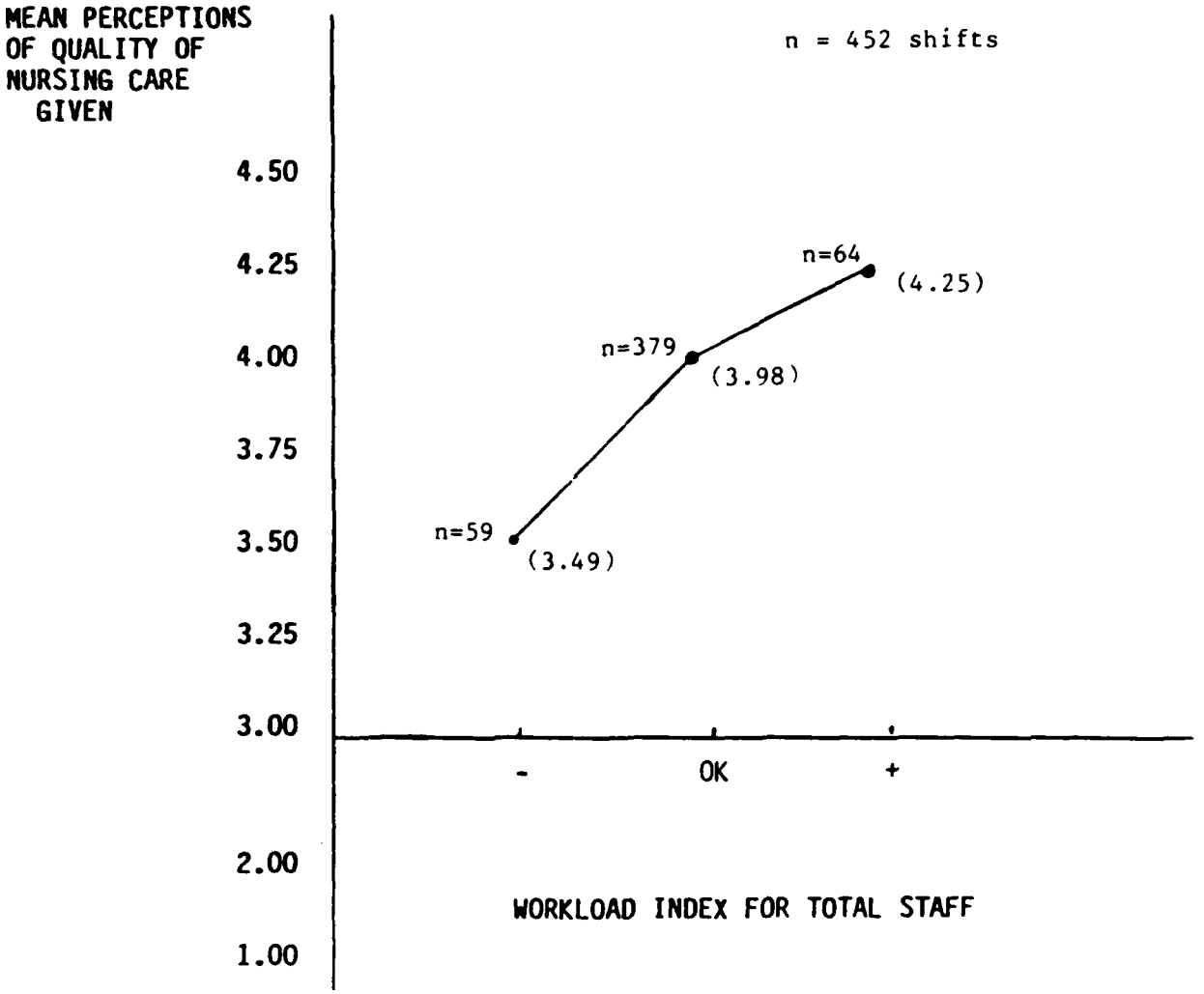
as below the recommended staffing level, 401 shifts at the recommended staffing level, and 69 shifts above the recommended staffing level. Charge nurses on 452 of the 544 shifts (83%) responded to the quality and staffing adequacy questions and became the sample for analysis. (See Appendices A9-F9 for Workload Index at each study facility.)

To evaluate the relationship between actual staffing, perceptions of staffing adequacy, and perceptions of quality of care given, mean charge nurse perceptions were compared to the Workload Index ($^{+}2$ staff, ± 1 staff, and -2 staff levels) for each shift using the Scheffe method. Results of the multiple comparisons revealed significant ($p < .05$) differences between the three staffing levels based on responses to the single item questions of how well quality care was provided (Figure 1) and how adequately a unit was staffed (Figure 2). In addition, significant positive linear relationships were found between the Workload Index and perception of quality care ($r = .28$, $p < .01$) and staffing adequacy ($r = .24$, $p < .01$).

g. Nurses' Perceptions of Direct and Indirect Care Activities Performed Under Various Staffing Levels. Both charge nurses (n = 468) and staff nurses (n = 464) rated the quality of direct and indirect nursing care provided on each shift using the Nursing Care Evaluation Form. This tool included two nine item subscales: direct care activities and indirect care activities. Using those cases in which subjects responded to all items, the internal consistency (Cronbach's alpha) for both subscales was .98 (direct care n = 408) (indirect care n = 368). Perceptions of quality care provided differed between the two groups for vital signs ($F = 5.91$, $p < .01$) and for administrative duties ($F = 4.67$, $p < .03$) with staff nurses rating these activities higher than charge nurses.

FIGURE 1

RELATIONSHIP OF CHARGE NURSES' PERCEPTIONS OF QUALITY NURSING CARE GIVEN WITH THE WORKLOAD INDEX[a]

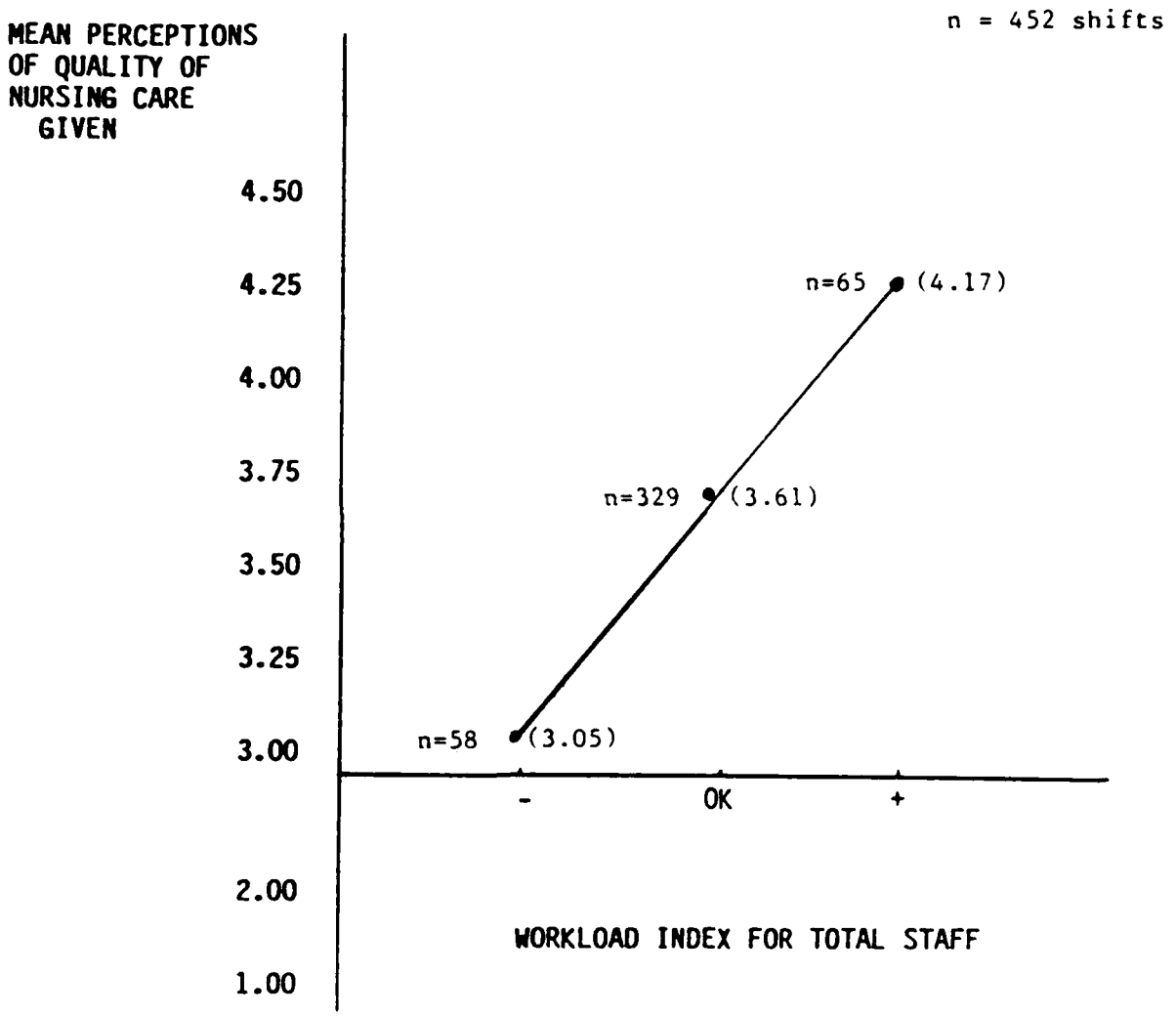


[a]All comparisons significant at .05 level.

Key: - = Less than recommended staffing level (minus 2 staff or more).
OK = At recommended staffing Level (minus or plus 1 staff).
+ = Greater than recommended staffing level (plus 2 staff or more).

FIGURE 2

RELATIONSHIP OF CHARGE NURSES' PERCEPTIONS OF STAFFING ADEQUACY WITH THE WORKLOAD INDEX[a]



[a]All comparisons significant at .05 level.

Key: - = Less than recommended staffing level (minus 2 staff or more).
OK = At recommended staffing level (minus or plus 1 staff).
+ = Greater than recommended staffing level (plus 2 staff or more).

Each direct and indirect care nursing activity was analyzed by total responses (n = 932) to determine nurses' perceptions of how "well" these tasks were accomplished. Separate analyses of the nine factors of direct nursing care (simple and complex treatments were combined into one variable) revealed two factors that were judged as being provided "less than adequately" by a relatively large percentage of nurses. They were teaching (17%) and emotional support (21%). Indirect care components judged as completed "less than adequately" by a large percentage of nurses were: a) initiating and updating the patient care plan (40%); b) administrative duties (33%); c) rounds with physicians (39%); d) personal time to include meals and breaks (28%); and e) orienting new personnel (24%).

In order to ascertain the relationship between actual staffing levels and perceptions of how well direct and indirect care activities were performed, registered nurse staffing on 452 shifts was categorized into three levels using the aforementioned Workload Index criteria. Results of an ANOVA to compare the <u>composite</u> subscale mean values for both direct and indirect care (Table 15) revealed significant differences in the values ($p < .01$) across all index levels. Multiple comparisons using the Scheffe procedure demonstrated that the composite subscale means were significantly different from each other ($p < .05$) across all Index levels.

To determine if the mean values of the <u>individual</u> nursing factors (groups of activities) comprising the subscales differed based on the Workload Index, separate analyses were conducted. For both the direct care (Table 16) and indirect care factors (Table 17), the mean values were significantly different ($p < .01$). Multiple mean comparisons revealed that <u>all</u> means for the factors in both subscales differed significantly ($p < .05$) except for

TABLE 15

MEANS, STANDARD DEVIATIONS, AND F-TEST VALUES ON PERCEPTIONS FOR DIRECT AND INDIRECT CARE ACTIVITIES SUBSCALES AND THE WMSN WORKLOAD INDEX FOR REGISTERED NURSES

	Below Recommended			Recommended			Above Recommended			
SUBSCALES	n	M	S.D.	n	M	S.D.	n	M	S.D.	F-Test Values
Direct Care	75	3.34	.89	706	3.94	.75	64	4.36	.63	33.03**
Indirect Care	76	2.83	.85	698	3.50	.87	65	4.00	.69	34.14**

$p < .0001$

TABLE 16

MEANS, STANDARD DEVIATIONS, AND F-TEST VALUES ON PERCEPTIONS OF DIRECT CARE ACTIVITIES PROVIDED AND THE WMSN WORKLOAD INDEX FOR REGISTERED NURSES

	Below Recommended			Recommended			Above Recommended			
Factor	n	M	S.D.	n	M	S.D.	n	M	S.D.	F-Test Value
Vital Signs	75	3.73	.82	699	4.27	.73	63	4.66	.56	28.92**
Monitor	73	3.45	.92	695	4.03	.84	63	4.21	.79	23.45**
ADL	75	3.22	1.08	673	3.89	.90	64	4.32	.77	27.09**
Feeding	60	3.50	.94	465	3.99	.83	31	4.32	.87	11.99**
Treatments	69	3.37	1.00	684	4.04	.89	63	4.46	.73	25.87**
Respiratory	65	3.29	1.05	557	3.78	.93	49	4.32	.77	17.05**
IVs	68	3.58	1.01	647	4.03	.85	63	4.42	.66	15.94**
Teaching	51	2.64	1.24	558	3.65	1.10	56	4.19	.88	27.98**
Emotional Support	68	2.69	1.24	594	3.43	1.14	60	3.91	.80	19.94**

** $p < .0001$

TABLE 17

MEANS, STANDARD DEVIATIONS, AND F-TEST VALUES ON PERCEPTIONS OF INDIRECT CARE ACTIVITIES PROVIDED AND THE WMSN WORKLOAD INDEX FOR REGISTERED NURSES

	Below Recommended			Recommended			Above Recommended			
ACTIVITIES	n	M	S.D.	n	M	S.D.	n	M	S.D.	F-Test Value
Charting	76	3.09	.95	693	3.63	.87	64	3.93	.83	17.94**
MD Orders	74	3.66	.72	669	4.10	.79	63	4.46	.73	18.16**
RN Orders	73	3.08	1.07	642	3.75	.95	59	4.15	.92	22.31**
Care Plan	72	2.09	1.17	669	2.83	1.30	64	3.60	1.06	23.85**
Admin	44	1.90	1.05	413	3.00	1.28	57	3.80	1.05	28.77**
Rounds	68	3.14	1.06	688	3.91	.98	63	4.38	.70	28.09**
MD Rounds	50	2.20	1.17	421	2.87	1.38	48	3.50	1.14	11.41**
Personnel Time	71	2.67	1.14	618	3.25	1.30	64	4.00	.92	18.65**
Orientation	44	2.36	1.14	483	3.38	1.19	58	3.98	.92	24.25**

** $p < .0001$

feeding, which differed only if the RN staff was below (-2) recommended. These findings lend support to the predictive validity of the WMSN patient classification and staffing methodology based upon perceptions of the professional staff working on the units surveyed.

5. DISCUSSION.

A review of reliability by category agreement across the six facilities indicated that the lowest reliability existed within the two teaching hospitals. Although the two facilities accounted for 46% (n = 105) of the total patients classified, a preponderance of the patients (63%) resided on the medical units and required complex treatments and procedures as well as teaching and emotional support. As evidenced by a review of the findings, both the complex treatment and emotional support factors had low intra-class correlations. For both factors, lack of appropriate documentation appeared to be the issue. Specifically, the complexity of the treatments and numbers of staff required to provide that care could not be discerned from the patient care plans or nurses notes. Moreover, the nurse expert could not always locate the documentation of a patient problem requiring emotional support to validate the points credited for this factor. The measurement reliability in these nursing care activities would probably have been higher if documentation had not been a requisite for crediting activities.

Several authors have indicated that the validity of a system, specifically predictive validity, is a key facet of any prospective staffing methodology based upon perceived nursing care requirements (Giovannetti, 1979; Giovannetti & Mayer, 1984). The finding that the WMSN direct care Patient Classification instrument correlated highly with the Nursing Care

Hour Standards (NCHS) instrument, developed so rigorously by the Army, was not surprising. Although the Army and Navy classification tools had been developed independently, the direct care time coefficients for each indicator of the WMSN were derived from the 1981 Army study and modified slightly based on current practice, expert nursing judgment, and repeated standard time studies.

Predictive validity for the indirect care portion of the system was a more complex issue. Lacking the resources to conduct a rigorous study of how nursing personnel spend their duty time across various Navy facilities, the system developers had derived a formula which distributed staff time across direct and indirect care activities. The basis for these percentages was historical data and expert opinion. To determine if the hours of care accurately reflected time required to provide direct and indirect care, charge nurses' perceptions of staffing adequacy on a shift basis were solicited, as well as nurses' general perceptions of satisfaction with the system.

The finding that charge nurses' perceptions of staffing adequacy and quality of care provided were significantly correlated with the staffing recommended by the WMSN gave initial credence to the established hours of care. However, further analyses revealed that the indirect care time built into the system may be inadequate. Though the Workload Index revealed that only 13% of the 452 shifts were understaffed by -2 personnel, several indirect care activities were judged as completed inadequately by a large percentage of respondents. In fact, perceptions of administrative duties completed ($\bar{x}$ = 2.9), of patient rounds made with physicians ($\bar{x}$ = 2.8), and of care plans written ($\bar{x}$ = 2.8) were less than adequate. A parallel study conducted by Misener and Freline (1983) reported that, across nine Army

hospitals, time spent by nursing care providers was distributed as 28.5% for direct care, 56.5% for indirect care, and 15% as unavailable for patient care. In addition, a re-examination of results from a study conducted by Kelly (1980) in three naval hospitals provided support for these staff time distributions. The time percentages were further validated by results reported by Lake (1982) for the civilian community. Although the operational definitions and categorizations differed slightly, the percentages of time spent on direct and indirect care within the military and civilian setting did not differ substantively (Misener & Freline, 1983). The WMSN system evaluated in this study did not include unavailable time and provided 45-75% indirect care time for various hospitals. Based on the above, a requirements model predicated on the current WMSN percentages does not appear to give adequate time for indirect care functions.

A significant finding was the relationship between the Workload Index and nurses' perceptions of how well direct and indirect nursing care was provided. Although classification systems have been judged as extremely effective in matching workload to numbers of staff, the linkage between quantity of nursing personnel to quality of outcome has been elusive. The results of this study demonstrate that quality, as defined by perceptions of how "well" nursing care was provided, is linearly related to the numbers of staff available to give that care on a nursing unit. Granted, these results do not specifically address patient outcomes, but past research has shown that professional nursing judgment accurately reflects the "actual" unit situation (Giovannetti & Mayer, 1984). Therefore, these results give some credence to the assumptions that quantity and category of staff (i.e., RN) are directly related to quality of care provided.

In general, nurses were satisfied with the system, perceiving it to be useful for management purposes. However, this perception of satisfaction was significantly affected by whether the nurse was involved with the entire system, or with only the patient classification portion, and by the specialty unit on which the nurse worked. Except for two factors, charge nurses' and staff nurses' perceptions of how "well" care was provided were similar for both direct and indirect patient care activities. Charge Nurses' perceptions of quality of care given and staffing adequacy on a particular shift were significantly related to staffing levels.

A review of written commentaries from the study sample of 434 Registered Nurses revealed several generalizations that could be made across hospitals. These included:

1. Staff nurses were confused about what types of activities are included in the patient classification Critical Indicator sheet. Numerous recommendations were received to include items that were indirect care tasks.
2. The most frequently suggested changes to the direct care activities were to include time for discharge teaching and isolation, and more time for providing care to a newborn.
3. Dissatisfaction with the system was greater among nurses who worked in specialty units, i.e., Labor and Delivery, Intensive Care, and Nursery.
4. Sources of frustration with the system focused on non-availability of additional manpower to cover staffing deficits and perceptions that management does not use the WMSN as a staffing guide.

6. CONCLUSIONS.

As a result of this study, the following conclusions are made:

1. The WMSN patient classification tool was found to be a reliable tool for measuring nursing care hour requirements by patient category across all study hospitals. Thus, the first hypothesis was supported.
2. The WMSN classification tool reliably measured nursing care requirements on all specialty units except medicine. Thus, the second hypothesis was partially supported.
3. There was a high degree of reliability among most factors in the patient classification instrument. Of the ten factors, only complex treatments, teaching, simple treatments, and emotional support resulted in an ICC value below .90. Thus, the third hypothesis was supported.
4. The validity coefficient for the classification tool was established by comparing it to an existing tool which possessed both content and criterion-related validity. The results demonstrated a high correlation between the two instruments, thus supporting the fourth hypothesis.
5. A majority (74.4%) of the sample expressed satisfaction or a neutral attitude toward the system. Perceptions of satisfaction were highly correlated with having reviewed or having had input into staffing decisions. Thus, the fifth hypothesis which specified finding greater satisfaction than dissatisfaction with the system was supported.

6. Charge nurses' perceptions of staffing adequacy and quality of care given were significantly (positively) related to staffing as recommended by the WMSN. Thus, the sixth hypothesis was supported.
7. Nurses' perceptions of how well direct care and indirect care activities were provided to patients were significantly related to quantity of staff, particularly registered nurse staff, as measured by the WMSN Workload Index. Thus, the seventh hypothesis was supported.

7. RECOMMENDATIONS

This section is divided into two parts. The first presents recommendations that have already been implemented. By describing these, the authors will provide documentation of the transition that has occurred in the system since the completion of this evaluative study. The second section addresses those recommendations that are still being considered or are ongoing in execution.

a. Completed Recommendations.

1. Based on the study findings, changes in the critical indicator tool to incorporate discharge teaching and isolation were made. Point values on some critical indicators were also adjusted based on the results of the validity study.
2. The percentages of direct, indirect, and non-available time by specialty services were adjusted to more accurately reflect staff time distributions. With this change the original indirect care time breakdowns (unpredicted needs, teaching hospital allowance,

and semi-private room allowances) were eliminated. Therefore, nursing care time for category of care (Class I-VI) now differs slightly depending on the type of patient being treated, i.e., psychiatric, medical-surgical, obstetric and gynecologic, pediatric, critical care, or normal newborn.

3. The charge nurse and senior corpsperson assigned to a unit during the week were eliminated from the staff counted as direct care providers. These two staff members provide support and act as resources to direct care staff. The administrative duties they perform (staffing, evaluations, orientation of new staff) were excluded from the indirect care percentages.
4. The WMSN Educational Workbook was re-written and distributed to all hospitals in June 1985 to disseminate the changes. Along with the workbook, new Nursing Care Hour Requirements Charts by specialty unit, with their corresponding Personnel Requirements Charts for both 8 hour and 12 hour shifts, were provided. All hospitals were given a 1 September 1985 implementation date.
5. To continue development of the system, a Nurse Corps officer has been assigned to the Research Department at NSHS as the WMSN Project Officer. Position duties include managing the system, refining the patient classification instrument for specialty areas, and assisting in or conducting studies which involve analysis of nursing workload.

b. Proposed Recommendations.

1. Because the current WMSN does not address patient care requirements in Labor and Delivery, Recovery Room, or Ambulatory

Care, it is recommended that the system be further developed to encompass nursing workload in these areas.

2. Due to the findings that staff nurses were unclear as to the composition of the patient classification tool, it is recommended that orientation to the system be ongoing with emphasis on documented proficiency in classifying patients.
3. To support learning and to standardize teaching, it is recommended that a video tape be created to complement the workbook and be distributed to all hospitals.
4. To institutionalize the nursing system, it is recommended that a Naval Medical Command instruction be written and that standardized forms be made available through the Government Printing Office.
5. It is recommended that reliability in use of the system be assessed monthly with mandatory retraining if percentage of rater agreement falls below 80 percent.
6. Validity assessment of both the classification and staffing portions of the system should be ongoing. It is recommended that the critical indicators and their corresponding weighted time values be re-validated every two years to keep pace with changes in technology and professional practice. The percentages of staff time spent in direct and indirect care activities should also be re-validated periodically using sampling techniques.
7. To aggregate and collate facility workload information in a usable format and timely manner, it is recommended that nursing services process their data on microcomputers. A Zenith software

program written specifically for generating WMSN output reports is presently available.

8. To minimize data entry time and ensure accurate input of the patient classification information, a mark sense version of the Critical Indicator Sheet is currently being developed in cooperation with the Army. Data from these forms could be automatically entered into a microcomputer using an optical scanner. Therefore, it is recommended that scanners be made available to all nursing services.
9. Once a mechanism for downloading facility specific data to the Naval Medical Data Services Center mainframe has been developed, it is recommended that quarterly reports which aggregate nursing workload data across facilities be produced for headquarters decision-making. This concurrent picture of staffing requirement based upon patient needs could be used to validate the CNO directed Navy Manpower Engineering Program Staffing Standards for Nursing.

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APPENDICES A - F

Appendices A - F are comprised of the site specific data for the individual Naval hospitals.

APPENDIX A

NAVAL HOSPITAL CHERRY POINT

CHERRY POINT, NORTH CAROLINA

APPENDIX A-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT NAVAL HOSPITAL CHERRY POINT

A. Sex:		Frequency	Percent
Males		5	25%
Females		15	75%
	n =	20	100%

B. Age Range:

40% of nurses are under age 35 years

60% of nurses are under age 40 years

C, Nursing position:		Frequency	Percent
Staff Nurses		16	80%
Charge Nurses		3	15%
Supervisors, Administrators, Others		1	5%
	n =	20	100%

APPENDIX A-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING THE CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL CHERRY POINT

NURSE EXPERT RATING

CHARGE NURSE RATING

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	TOTAL
1	4	1	0	5
	22.22	5.56	0.00	27.78
Category	80.00	20.00	0.00	
	80.00	11.11	0.00	
2	1	8	0	9
	5.56	44.44	0.00	50.00
Category	11.11	88.89	0.00	
	20.00	88.89	0.00	
3	0	0	4	4
	0.00	0.00	22.22	22.22
Category	0.00	0.00	100.00	
	0.00	0.00	100.00	
TOTAL	5	9	4	18
	27.78	50.00	22.22	100.00

Percent of Agreement = 16/18 or 88.89%
Kappa Statistic = .82
Standard Deviation of Kappa = .133
Z Score = 6.9
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX A-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL CHERRY POINT

Factor	Intra-Class Correlation (ICC)
Vital Signs	.983
Monitoring	.956
Activities of Daily Living	.694
Feeding	.987
Simple Treatments	.394
Complex Treatments	---
Respiratory Therapy	.434
Intravenous Therapy	.847
Teaching	.917
Emotional Support	-.150
Continuous Care	---
Total	.921

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX A-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL CHERRY POINT

NURSING POSITION	Frequency / Row Pct / Col Pct	PERCEPTIONS OF ACCURACY OF WMSN: Usually	Sometime	TOTAL
STAFF NURSE		3	13	16
		18.75	81.25	
		50.00	92.86	
CHARGE NURSE		2	1	3
		66.67	33.33	
		33.33	7.14	
SUPERVISORY		1	0	1
		100.00	0.00	
		16.67	0.00	
TOTAL		6	14	20

Chi Square = 5.218
Degrees of Freedom = 2
Probability = .0736
Note: 5 cells have less than 5 cases.

APPENDIX A-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT NAVAL HOSPITAL CHERRY POINT

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		2	7	7	16
		12.50	43.75	43.75	
		40.00	87.50	100.00	
CHARGE NURSE		2	1	0	3
		66.67	33.33	0.00	
		40.00	12.50	0.00	
SUPERVISORY		1	0	0	1
		100.00	0.00	0.00	
		20.00	0.00	0.00	
TOTAL		5	8	7	20

Chi Square = 7.573
Degrees of Freedom = 4
Probability = .1085
Note: 7 cells have less than 5 cases.

APPENDIX A-6

SATISFACTION WITH THE WMSN AS A WHOLE BY NURSING POSITON AT NAVAL HOSPITAL CHERRY POINT

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		1	10	5	16
		6.25	62.50	31.25	
		25.00	100.00	83.33	
CHARGE NURSE		2	0	1	3
		66.67	0.00	33.33	
		50.00	0.00	16.67	
SUPERVISORY		1	0	0	1
		100.00	0.00	0.00	
		25.00	0.00	0.00	
TOTAL		4	13	6	20

Chi Square = 10.799
Degrees of Freedom = 4
Probability = .0289
Note: 8 cells have less than 5 cases.

APPENDIX A-7

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CHERRY POINT

Variable	Agree Frequency	Percent
Ease Of Use	8	40%
Usefulness As a Management Tool	6	30%
Takes Little Time To Do	4	20%
Reliable	2	10%
Accurately Reflects Workload	1	5%

n = 20 nurses

(More than one response could be selected)

APPENDIX A-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CHERRY POINT

Variable	Agree Frequency	Percent
Not Comprehensive	11	55%
Inaccurate In Reflecting Workload	10	50%
Unreliable	7	35%
Takes Long Time To Do	3	15%
Not useful As A Management Tool	3	15%
Difficult To Use	3	15%

n = 20 nurses

(More than one response could be selected)

APPENDIX A-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL CHERRY POINT

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	---	---
**Recommended	22	91.67%
***Greater than recommended	2	8.33%
	24	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	1	4.17%
**Recommended	21	87.5%
***Greater than recommended	2	8.33%
	24	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	1	4.17%
**Recommended	17	70.83%
***Greater than recommended	6	25.00%
	24	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDIX B

NAVAL HOSPITAL LEMOORE

LEMOORE, CALIFORNIA

APPENDIX B-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT NAVAL HOSPITAL LEMOORE

A. Sex:		Frequency	Percent
Males		4	31%
Females		9	69%
	n =	13	100%

B. Age Range:

69% of nurses are under age 35 years

100% of nurses are under age 40 years

C, Nursing position:		Frequency	Percent
Staff Nurses		11	84.6%
Charge Nurses		2	15.4%
Supervisors, Administrators, Others		---	---
	n =	13	100%

APPENDIX B-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL LEMOORE

Nurse Expert Rating

Charge Nurse Rating

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	TOTAL
1	3	1	0	4
	16.67	5.56	0.00	22.22
Category	75.00	25.00	0.00	
	100.00	7.14	0.00	
2	0	13	0	13
	0.00	72.22	0.00	72.22
Category	0.00	100.00	0.00	
	0.00	92.86	0.00	
3	0	0	1	1
	0.00	0.00	5.56	5.56
Category	0.00	0.00	100.00	
	0.00	0.00	100.00	
TOTAL	3	14	1	18
	16.67	77.78	5.56	100.00

Percent of Agreement = 17/18 or 97.44%
Kappa Statistic = .86
Standard Deviation of Kappa = .1365
Z Score = 6.3
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX B-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL LEMOORE

Factor	Intra-Class Correlation (ICC)
Vital Signs	.894
Monitoring	.610
Activities of Daily Living	.981
Feeding	.896
Simple Treatments	.772
Complex Treatments	---
Respiratory Therapy	.970
Intravenous Therapy	.930
Teaching	.923
Emotional Support	---
Continuous Care	---
Total	.909

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX B-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL LEMOORE

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN: USUALLY	SOMETIMES	TOTAL
STAFF NURSE		6	4	10
		60.00	40.00	
		85.71	80.00	
CHARGE NURSE		1	1	2
		50.00	50.00	
		14.29	20.00	
TOTAL		7	5	12

Missing Cases = 1
Chi Square = .069
Degrees of Freedom = 1
Probability = .7934
Note: 3 cells have less than 5 cases.

APPENDIX B-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT NAVAL HOSPITAL LEMOORE

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	TOTAL
STAFF NURSE		5	5	10
		50.00	50.00	
		83.33	83.33	
CHARGE NURSE		1	1	2
		50.00	50.00	
		16.67	16.67	
TOTAL		6	6	12

Missing Cases = 1
Chi Square = .000
Degrees of Freedom = 1
Probability = 1
Note: Cells so sparse not valid.

APPENDIX B-6

SATISFACTION WITH THE WMSN AS A WHOLE BY NURSING POSITION AT NAVAL HOSPITAL LEMOORE

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		4	4	1	9
		44.44	44.44	11.11	
		80.00	80.00	100.00	
CHARGE NURSE		1	1	0	2
		50.00	50.00	0.00	
		20.00	20.00	0.00	
TOTAL		5	5	1	11

Chi Square = .244
Degrees of Freedom = 2
Probability = .8856

APPENDIX B-7

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL LEMOORE

Variable	Agree Frequency	Percent
Comprehensive	6	46.154%
Ease Of Use	4	30.769%
Usefulness As a Management Tool	4	30.769%
Takes Little Time To Do	3	23.077%
Accurately Reflects Workload	3	23.077%
Reliable	2	15.385%

n = 13 nurses

(More than one response could be selected)

APPENDIX B-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL LEMOORE

Variable	Agree Frequency	Percent
Unreliable	5	38.462%
Not Comprehensive	4	30.769%
Takes Long Time To Do	3	23.077%
Difficult To Use	2	15.385%
Inaccurate In Reflecting Workload	1	7.692%

n = 13 nurses

(More than one response could be selected)

APPENDIX B-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL LEMOORE

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	---	---
**Recommended	25	92.59%
***Greater than recommended	2	7.41%
	27	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	---	---
**Recommended	26	96.3%
***Greater than recommended	1	3.7%
	27	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	---	---
**Recommended level	23	85.19%
***Greater than recommended	4	14.81%
	27	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDIX C

NAVAL HOSPITAL CAMP PENDLETON

CAMP PENDLETON, CALIFORNIA

APPENDIX C-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT NAVAL HOSPITAL CAMP PENDLETON

A. Sex:		Frequency	Percent
Males		8	14%
Females		49	86%
	n =	57	100%

B. Age Range:

56% of nurses are under age 35 years

70% of nurses are under age 40 years

C, Nursing position:		Frequency	Percent
Staff Nurses		40	70.2%
Charge Nurses		7	12.3%
Supervisors, Administrators, Others		10	17.5%
	n =	57	100%

APPENDIX C-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING THE CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL CAMP PENDLETON

NURSING EXPERT RATING

CHARGE NURSE RATING

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	TOTAL
1	17	2	0	0	19
	33.33	3.92	0.00	0.00	37.25
Category	89.47	10.53	0.00	0.00	
	100.00	13.33	0.00	0.00	
2	0	13	3	0	16
	0.00	25.49	5.88	0.00	31.37
Category	0.00	81.25	18.75	0.00	
	0.00	86.67	21.43	0.00	
3	0	0	11	1	12
	0.00	0.00	21.57	1.96	23.53
Category	0.00	0.00	91.67	8.33	
	0.00	0.00	78.57	20.00	
4	0	0	0	4	4
	0.00	0.00	0.00	7.84	7.84
Category	0.00	0.00	0.00	100.00	
	0.00	0.00	0.00	80.00	
TOTAL	17	15	14	5	51
	33.33	29.41	27.45	9.80	100.00

Percent of Agreement = 45/51 or 88.24%
Kappa Statistic = .83
Standard Deviation of Kappa = .063
Z Score = 13.2
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX C-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL CAMP PENDLETON

Factor	Intra-Class Correlation (ICC)
Vital Signs	.989
Monitoring	.931
Activities of Daily Living	.9035
Feeding	.965
Simple Treatments	.881
Complex Treatments	.793
Respiratory Therapy	.904
Intravenous Therapy	.873
Teaching	.717
Emotional Support	.649
Continuous Care	---
Total	.953

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX C-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL CAMP PENDLETON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN			TOTAL
		USUALLY	SOMETIMES	NEVER	
STAFF NURSE		15	23	2	40
		37.50	57.50	5.00	
		60.00	82.14	100.00	
CHARGE NURSE		5	1	0	6
		83.33	16.67	0.00	
		20.00	3.57	0.00	
SUPERVISORY		5	4	0	9
		55.56	44.44	0.00	
		20.00	14.29	0.00	
TOTAL		25	28	2	55

Missing Cases = 2
Chi Square = 5.200
Degrees of Freedom = 4
Probability = .2674
Note: 5 cells have less than 5 cases.

APPENDIX C-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT NAVAL HOSPITAL CAMP PENDLETON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		16	12	12	40
		40.00	30.00	30.00	
		53.33	85.71	100.00	
CHARGE NURSE		5	1	0	6
		83.33	16.67	0.00	
		16.67	7.14	0.00	
SUPERVISORY		9	1	0	10
		90.00	10.00	0.00	
		30.00	7.14	0.00	
TOTAL		30	14	12	56

Missing Cases = 1
Chi Square = 11.111
Degrees of Freedom = 4
Probability = .0253
Note: 4 cells have less than 5 cases.

APPENDIX C-6

SATISFACTION WITH THE WMSN AS A WHOLE BY NURSING POSITION AT NAVAL HOSPITAL CAMP PENDLETON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		9	15	15	39
		23.08	38.46	38.46	
		52.94	75.00	83.33	
CHARGE NURSE		3	2	2	7
		42.86	28.57	28.57	
		17.65	10.00	11.11	
SUPERVISORY		5	3	1	9
		55.56	33.33	11.11	
		29.41	15.00	5.56	
TOTAL		17	20	18	55

Missing Cases = 2
Chi Sqaure = 4.767
Degrees of Freedom = 4
Probability = .3121
Note: 5 cells have less than 5 cases.

APPENDIX C-7

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CAMP PENDLETON

Variable	Agree Frequency	Percent
Ease Of Use	19	33.333%
Usefulness As a Management Tool	17	29.825%
Takes Little Time To Do	14	24.561%
Reliable	10	17.544%
Comprehensive	8	14.035%
Accurately Reflects Workload	8	14.035%

n = 57 nurses

(More than one response could be selected)

APPENDIX C-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CAMP PENDLETON

Variable	Agree Frequency	Percent
Inaccurate In Reflecting Workload	30	52.632%
Not Comprehensive	20	35.088%
Unreliable	20	35.088%
Takes Long Time To Do	13	23.807%
Not Useful As A Management Tool	5	8.772%
Difficult To Use	3	5.263%

n = 57 nurses

(More than one response could be selected)

APPENDIX C-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL CAMP PENDLETON

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	3	4.76%
**Recommended	59	93.65%
***Greater than recommended	1	1.59%
	63	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	10	15.87%
**Recommended	45	71.43%
***Greater than recommended	8	12.7%
	63	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended level	13	20.64%
**At recommended level	43	68.25%
***Greater than recommended level	7	11.11%
	63	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDIX D

NAVAL HOSPITAL CHARLESTON

CHARLESTON, SOUTH CAROLINA

APPENDIX D-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT NAVAL HOSPITAL CHARLESTON

A. Sex:	Frequency	Percent
Males	15	23.4%
Females	49	76.6%
n =	64	100%

B. Age Range:

70% of nurses were under age 35 years
81% of nurses were under age 40 years

C, Nursing position:	Frequency	Percent
Staff Nurses	51	79.7%
Charge Nurses	7	10.9%
Supervisors, Administrators, Others	6	9.4%
n =	64	100%

APPENDIX D-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING THE CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL CHARLESTON

NURSING EXPERT RATING

CHARGE NURSE RATING

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	Category 5	TOTAL
1	5	1	0	0	0	6
	13.51	2.70	0.00	0.00	0.00	16.22
Category	83.33	16.67	0.00	0.00	0.00	
	83.33	6.67	0.00	0.00	0.00	
2	1	13	1	0	0	15
	2.70	35.14	2.70	0.00	0.00	40.54
Category	6.67	86.67	6.67	0.00	0.00	
	16.67	86.67	7.69	0.00	0.00	
3	0	1	12	0	0	13
	0.00	2.70	32.43	0.00	0.00	35.14
Category	0.00	7.69	92.31	0.00	0.00	
	0.00	6.67	92.31	0.00	0.00	
4	0	0	0	2	0	2
	0.00	0.00	0.00	5.41	0.00	5.41
Category	0.00	0.00	0.00	100.00	0.00	
	0.00	0.00	0.00	100.00	0.00	
5	0	0	0	0	1	1
	0.00	0.00	0.00	0.00	2.70	2.70
	0.00	0.00	0.00	0.00	100.00	
Category	0.00	0.00	0.00	0.00	100.00	
TOTAL	6	15	13	2	1	37
	16.22	40.54	35.14	5.41	2.70	100.00

Percent of Agreement = 33/37 or 89.22
Kappa Statistic = .84
Standard Deviation of Kappa = .0748
Z Score = 11.247
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX D-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL CHARLESTON

Factor	Intra-Class Correlation (ICC)
Vital Signs	.928
Monitoring	.996
Activities of Daily Living	.997
Feeding	.959
Simple Treatments	.918
Complex Treatments	.828
Respiratory Therapy	.976
Intravenous Therapy	.976
Teaching	.793
Emotional Support	.763
Continuous Care	---
Total	.991

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX D-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL CHARLESTON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN: USUALLY	SOMETIMES	NEVER	TOTAL
STAFF NURSE		26	19	5	50
		52.00	38.00	10.00	
		70.27	90.48	100.00	
CHARGE NURSE		5	2	0	7
		71.43	28.57	0.00	
		13.51	9.52	0.00	
SUPERVISORY		6	0	0	6
		100.00	0.00	0.00	
		16.22	0.00	0.00	
TOTAL		37	21	5	63

Missing Cases = 1
Chi Square = 5.992
Degrees of Freedom = 4
Probability = .199
Note: 4 cells have less than 5 cases.

APPENDIX D-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT NAVAL HOSPITAL CHARLESTON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		24	19	7	50
		48.00	38.00	14.00	
		68.57	90.48	100.00	
CHARGE NURSE		5	2	0	7
		71.43	28.57	0.00	
		14.29	9.52	0.00	
SUPERVISORY		6	0	0	6
		100.00	0.00	0.00	
		17.14	0.00	0.00	
TOTAL		35	21	7	63

Missing Cases = 1
Chi Square = 2.159
Degrees of Freedom = 4
Probability = .1277
Note: 4 cells have less than 5 cases.

APPENDIX D-6

SATISFACTION WITH THE WMSN AS A WHOLE BY NURSING POSITION AT NAVAL HOSPITAL CHARLESTON

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		16	18	16	50
		32.00	36.00	32.00	
		61.54	90.00	94.12	
CHARGE NURSE		4	2	1	7
		57.14	28.57	14.29	
		15.38	10.00	5.88	
SUPERVISORY		6	0	0	6
		100.00	0.00	0.00	
		23.08	0.00	0.00	
TOTAL		26	20	17	63

Missing Cases = 1
Chi Square = 11.199
Degrees of Freedom = 4
Probability = .0248
Note: 5 cells have less than 5 cases.

APPENDIX D-7

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CHARLESTON

Variable	Agree Frequency	Percent
Usefulness As a Management Tool	35	54.688%
Ease Of Use	18	28.125%
Takes Little Time To Do	17	26.563%
Comprehensive	16	25.000%
Accurately Reflects Workload	11	17.188%
Reliable	8	12.500%

n = 64 nurses

(More than one response could be selected)

APPENDIX D-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL CHARLESTON

Variable	Agree Frequency	Percent
Inaccurate In Reflecting Workload	27	42.188%
Not Comprehensive	17	26.563%
Unreliable	13	20.313%
Takes Long Time To Do	12	18.75%
Not Useful As A Management Tool	4	6.25%
Difficult To Use	1	1.563%

n = 64 nurses

(More than one response could be selected)

APPENDIX D-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL CHARLESTON

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	4	6.35%
**Recommended	56	88.89%
***Greater than recommended	3	4.76%
	63	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	3	4.76%
**Recommended	59	93.65%
***Greater than recommended	1	1.59%
	63	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	8	12.7%
**Recommended level	47	74.6%
***Greater than recommended	8	12.7%
	63	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDIX E

NAVAL HOSPITAL OAKLAND

OAKLAND, CALIFORNIA

APPENDIX E-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT OAKLAND NAVAL HOSPITAL

A. Sex:	Frequency	Percent
Males	24	23.3%
Females	79	76.7%
n =	103	100%

B. Age Range:

78% of nurses are under age 35 years
92% of nurses are under 40 years

C, Nursing position:	Frequency	Percent
Staff Nurses	78	75.7%
Charge Nurses	10	9.7%
Supervisors, Administrators, Others	15	14.6%
n =	103	100%

APPENDIX E-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING THE CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL OAKLAND

NURSE EXPERT RATING

CHARGE NURSE RATING

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	TOTAL
1	6	1	0	0	7
	15.79	2.63	0.00	0.00	18.42
Category	85.71	14.29	0.00	0.00	
	85.71	6.67	0.00	0.00	
2	1	11	3	0	15
	2.63	28.95	7.89	0.00	39.47
Category	6.67	73.33	20.00	0.00	
	14.29	73.33	23.08	0.00	
3	0	3	10	0	13
	0.00	7.89	26.32	0.00	34.21
Category	0.00	23.08	76.92	0.00	
	0.00	20.00	76.92	0.00	
4	0	0	0	3	3
	0.00	0.00	0.00	7.89	7.89
Category	0.00	0.00	0.00	100.00	
	0.00	0.00	0.00	100.00	
TOTAL	7	15	13	3	38
	18.42	39.47	34.21	7.89	100.00

Percent of Agreement = 30/38 or 78.95%
Kappa Statistic = .69
Standard Deviation of Kappa = .096
Z Score = 7.2
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX E-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL OAKLAND

Factor	Intra-Class Correlation (ICC)
Vital Signs	.991
Monitoring	.996
Activities of Daily Living	.894
Feeding	.915
Simple Treatments	.546
Complex Treatments	.748
Respiratory Therapy	.961
Intravenous Therapy	.981
Teaching	.862
Emotional Support	.457
Continuous Care	---
Total	.963

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX E-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL OAKLAND

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN: USUALLY	SOMETIMES	NEVER	TOTAL
STAFF NURSE		32	40	3	75
		42.67	53.33	4.00	
		64.00	88.89	75.00	
CHARGE NURSE		6	3	1	10
		60.00	30.00	10.00	
		12.00	6.67	25.00	
SUPERVISORY		12	2	0	14
		85.71	14.29	0.00	
		24.00	4.44	0.00	
TOTAL		50	45	4	99

Missing = 4
Chi Square = 10.514
Degrees of Freedom = 4
Probability = .03
Note: 5 cells have less than 5 cases.

APPENDIX E-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT OAKLAND NAVAL HOSPITAL

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		31	22	22	75
		41.33	29.33	29.33	
		62.00	84.62	91.67	
CHARGE NURSE		7	2	1	10
		70.00	20.00	10.00	
		14.00	7.69	4.17	
SUPERVISORY		12	2	1	15
		80.00	13.33	6.67	
		24.00	7.69	4.17	
TOTAL		50	26	24	100

Missing Cases = 3
Chi Square = 9.595
Degrees of Freedom = 4
Note: 4 cells have less than 5 cases.

APPENDIX E-6

SATISFACTION WITH THE WMSN AS A WHOLE BY NURSING POSITION AT NAVAL HOSPITAL OAKLAND

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	SATISFACTION WITH WMSN: SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE		22	29	22	73
		30.14	39.73	30.14	
		61.11	85.29	81.48	
CHARGE NURSE		4	3	3	10
		40.00	30.00	30.00	
		11.11	8.82	11.11	
SUPERVISORY		10	2	2	14
		71.43	14.29	14.29	
		27.78	5.88	7.41	
TOTAL		36	34	27	97

Missing Cases = 6
Chi Square = 8.751
Degrees of Freedom = 4
Probability = .0676
Note: 5 cells have less than 5 cases.

APPENDIX E-7

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL OAKLAND

Variable	Agree Frequency	Percent
Usefulness As a Management Tool	43	41.748%
Ease Of Use	27	26.214%
Reliable	20	19.417%
Takes Little Time To Do	19	18.447%
Comprehensive	10	9.709%
Accurately Reflects Workload	10	9.709%

n = 103 nurses

(More than one response could be selected)

APPENDIX E-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL OAKLAND

Variable	Agree Frequency	Percent
Not Comprehensive	41	39.806%
Inaccurate In Reflecting Workload	32	32.068%
Unreliable	29	28.155%
Takes Long Time To Do	23	22.33%
Not Useful As A Management Tool	11	10.68%
Difficult To Use	4	3.883%

n = 103 nurses

(More than one response could be selected)

APPENDIX E-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL OAKLAND

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	---	---
**Recommended	141	92.16%
***Greater than recommended	12	7.84%
	153	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	7	4.58%
**Recommended	139	90.85%
***Greater than recommended	7	4.58%
	153	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	13	8.50%
**Recommended	112	72.20%
***Greater than recommended	28	18.30%
	153	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDIX F

NAVAL HOSPITAL PORTSMOUTH

PORTSMOUTH, VIRGINIA

APPENDIX F-1

DEMOGRAPHIC PROFILE OF NURSE PARTICIPANTS AT NAVAL HOSPITAL PORTSMOUTH

A. Sex:	Frequency	Percent
Males	22	12.4%
Females	155	87.6%
n =	177	100%

B. Age Range:

61% of nurses are under age 35 years
81% of nurses are under 40 years

C, Nursing position:	Frequency	Percent
Staff Nurses	145	81.9%
Charge Nurses	24	13.6%
Supervisors, Administrators, Others	8	4.5%
n =	177	100%

APPENDIX F-2

COMPARISON OF PATIENT CLASSIFICATION CATEGORY AGREEMENT BETWEEN NURSE EXPERT AND CHARGE NURSE CLASSIFIERS USING THE CRITICAL INDICATOR INSTRUMENT AT NAVAL HOSPITAL PORTSMOUTH

NURSE EXPERT RATING

CHARGE NURSE RATING

FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	Category 5	TOTAL
1	7	3	0	0	0	10
	10.45	4.48	0.00	0.00	0.00	14.93
Category	70.00	30.00	0.00	0.00	0.00	
	100.00	10.00	0.00	0.00	0.00	
2	0	27	8	0	0	35
	0.00	40.30	11.94	0.00	0.00	52.24
Category	0.00	77.14	22.86	0.00	0.00	
	0.00	90.00	38.10	0.00	0.00	
3	0	0	13	1	0	14
	0.00	0.00	19.40	1.49	0.00	20.90
Category	0.00	0.00	92.86	7.14	0.00	
	0.00	0.00	61.90	25.00	0.00	
4	0	0	0	3	1	4
	0.00	0.00	0.00	4.48	1.49	5.97
Category	0.00	0.00	0.00	75.00	25.00	
	0.00	0.00	0.00	75.00	20.00	
5	0	0	0	0	4	4
	0.00	0.00	0.00	0.00	5.97	5.97
Category	0.00	0.00	0.00	0.00	100.00	
	0.00	0.00	0.00	0.00	80.00	
TOTAL	7	30	21	4	5	67
	10.45	44.78	31.34	5.97	7.46	100.00

Percent of Agreement = 54/67 or 80.6%
Kappa Statistic = .713
Standard Deviation of Kappa = .071
Z Score = 9.996
Category agreement was significant at $p < .001$ using Kappa Statistic.

APPENDIX F-3

INTER-RATER RELIABILITIES FOR FACTORS ON THE CRITICAL INDICATOR INSTRUMENT AS ESTIMATED BY ICC AT NAVAL HOSPITAL PORTSMOUTH

Factor	Intra-Class Correlation (ICC)
Vital Signs	.917
Monitoring	.945
Activities of Daily Living	.971
Feeding	.926
Simple Treatments	.639
Complex Treatments	---
Respiratory Therapy	.967
Intravenous Therapy	.921
Teaching	.414
Emotional Support	.248
Continuous Care	---
Total	.905

All factors were statistically significant at $p < .0001$ level using the F test.

APPENDIX F-4

PERCEPTIONS OF ACCURACY OF THE WMSN IN REFLECTING THE LEVEL OF CARE GIVEN BY NURSING POSITION AT NAVAL HOSPITAL PORTSMOUTH

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	PERCEPTIONS OF ACCURACY OF WMSN: USUALLY	SOMETIMES	TOTAL
STAFF NURSE		65	78	143
		45.45	54.55	
		73.03	92.86	
CHARGE NURSE		18	5	23
		78.26	21.74	
		20.22	5.95	
SUPERVISORY		6	1	7
		85.71	14.29	
		6.74	1.19	
TOTAL		89	84	173

Missing Cases = 4
Chi Square = 11.967
Degrees of Freedom = 2
Probability = .0025
Note: 1 cell has less than 5 cases.

APPENDIX F-5

PERCEPTIONS OF USEFULNESS OF THE WMSN AS A MANAGEMENT TOOL BY NURSING POSITION AT NAVAL HOSPITAL PORTSMOUTH

NURSING POSITION	FREQUENCY / ROW PCT / COL PCT	USEFULNESS OF WMSN AS A MANAGEMENT TOOL: USEFUL	UNDECIDED	NOT USEFUL	TOTAL
STAFF NURSE		55	59	26	140
		39.29	42.14	18.57	
		67.90	93.65	96.30	
CHARGE NURSE		19	3	1	23
		82.61	13.04	4.35	
		23.46	4.76	3.70	
SUPERVISORY		7	1	0	8
		87.50	12.50	0.00	
		8.64	1.59	0.00	
TOTAL		81	63	27	171

Missing Cases 6
Chi Square = 20.427
Degrees of Freedom = 4
Probability = .0004
Note: 4 cells haveless than 5 cases.

APPENDIX F-6

RANK ORDER OF MAJOR STRENGTHS OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL PORTSMOUTH

NURSING POSITION	SATISFACTION WITH WMSN			
FREQUENCY ROW PCT COL PCT	SATISFIED	NEUTRAL	DISSATISFIED	TOTAL
STAFF NURSE	41 29.08 64.06	64 45.39 91.43	36 25.53 94.74	141
CHARGE NURSE	17 73.91 26.56	4 17.39 5.71	2 8.70 5.26	23
SUPERVISORY	6 75.00 9.38	2 25.00 2.86	0 0.00 0.00	8
TOTAL	64	70	38	172

Missing Cases = 5
Chi Square = 22.611
Degrees of Freedom = 4
Probability = .0002
Note: 4 cells have less than 5 cases.

APPENDIX F-7

RANK ORDER OF MAJOR STRENGTHS OF THW WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL PORTSMOUTH

Variable	Agree Frequency	Percent
Usefulness As a Management Tool	65	36.723%
Ease Of Use	44	24.859%
Takes Little Time To Do	34	19.209%
Reliable	30	16.949%
Comprehensive	28	15.819%
Accurately Reflects Workload	26	14.689%

n = 177 nurses

(More than one response could be selected)

APPENDIX F-8

RANK ORDER OF MAJOR WEAKNESSES OF THE WORKLOAD MANAGEMENT SYSTEM AS PERCEIVED BY PROFESSIONAL NURSES AT NAVAL HOSPITAL PORTSMOUTH

Variable	Agree Frequency	Percent
Not Comprehensive	60	33.898%
Inaccurate In Reflecting Workload	59	33.333%
Unreliable	52	29.379%
Takes Long Time To Do	46	25.989%
Not Useful As A Management Tool	22	12.429%
Difficult To Use	6	3.390%

n = 177 nurses

(More than one response could be selected)

APPENDIX F-9

NURSING PERSONNEL STAFFING LEVELS FOR EACH SHIFT AS DETERMINED BY WORKLOAD INDEX CRITERIA AT NAVAL HOSPITAL PORTSMOUTH

A. RN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	36	16.82%
**At recommended	174	81.31%
***Greater than recommended	4	1.87%
	214	100%

B. NRN STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	13	6.07%
**Recommended	176	82.24%
***Greater than recommended	25	11.69%
	214	100%

C. TOTAL STAFF

Workload Index	Shifts	
	Frequency	Percent
*Less than recommended	39	18.22%
**Recommended	159	74.30%
***Greater than recommended	16	7.48%
	214	100%

Key to Levels:

*Less than recommended:	Minus 2 persons or more
**Recommended:	Minus 1 person to plus 1 person
***Greater than recommended:	Plus 2 persons or more

APPENDICES G1 - G6

Comparisons of patient classification category agreement between nurse expert and charge nurse classifiers for six specialty areas across six Naval Hospitals.

APPENDIX G-1

NURSERY UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATING

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	TOTAL
1		1	0	0	0	1
		3.85	0.00	0.00	0.00	3.85
	Category	100.00	0.00	0.00	0.00	
		50.00	0.00	0.00	0.00	
2		1	13	0	0	14
		3.85	50.00	0.00	0.00	53.85
	Category	7.14	92.86	0.00	0.00	
		50.00	100.00	0.00	0.00	
3		0	0	10	0	10
		0.00	0.00	38.46	0.00	38.46
	Category	0.00	0.00	100.00	0.00	
		0.00	0.00	100.00	0.00	
4		0	0	0	1	1
		0.00	0.00	0.00	3.85	3.85
	Category	0.00	0.00	0.00	100.00	
		0.00	0.00	0.00	100.00	
TOTAL		2	13	10	1	26
		7.69	50.00	38.46	3.85	100.00

Percent of Agreement = 25/26 or 96.15%

Kappa Statistic = .933

Standard Deviation of Kappa = .065

Z Score = 14.316

APPENDIX G-2

POST-PARTUM UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATING

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	TOTAL
Category 1		9	2	0	0	11
		27.27	6.06	0.00	0.00	33.33
		81.82	18.18	0.00	0.00	
		100.00	11.11	0.00	0.00	
Category 2		0	16	1	0	17
		0.00	48.48	3.03	0.00	51.52
		0.00	94.12	5.88	0.00	
		0.00	88.89	20.00	0.00	
Category 3		0	0	4	1	5
		0.00	0.00	12.12	3.03	15.15
		0.00	0.00	80.00	20.00	
		0.00	0.00	80.00	100.00	
TOTAL		9	18	5	1	33
		27.27	54.55	15.15	3.03	100.00

Percent of Agreement = 29/33 or 87.88%

Kappa Statistic = .7996

Standard Deviation of Kappa = .0938

Z Score = 8.5177

APPENDIX G-3

PEDIATRIC UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATINGS

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	TOTAL
1		2	0	0	0	2
		8.00	0.00	0.00	0.00	8.00
Category		100.00	0.00	0.00	0.00	
		100.00	0.00	0.00	0.00	
2		0	4	3	0	7
		0.00	16.00	12.00	0.00	28.00
Category		0.00	57.14	42.86	0.00	
		0.00	80.00	20.00	0.00	
3		0	1	12	0	13
		0.00	4.00	48.00	0.00	52.00
Category		0.00	7.69	92.31	0.00	
		0.00	20.00	80.00	0.00	
4		0	0	0	3	3
		0.00	0.00	0.00	12.00	12.00
Category		0.00	0.00	0.00	100.00	
		0.00	0.00	0.00	100.00	
TOTAL		2	5	15	3	25
		8.00	20.00	60.00	12.00	100.00

Percent of Agreement = 21/25 or 84%

Kappa Statistic = .738

Standard Deviation of Kappa = .119

Z Score = 6.1537

APPENDIX G-4

ICU/CCU UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATING

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 2	Category 3	Category 4	Category 5	TOTAL
Category 2		1	0	0	0	1
		5.56	0.00	0.00	0.00	5.56
		100.00	0.00	0.00	0.00	
		50.00	0.00	0.00	0.00	
Category 3		1	5	0	0	6
		5.56	27.78	0.00	0.00	33.33
		16.67	83.33	0.00	0.00	
		50.00	100.00	0.00	0.00	
Category 4		0	0	6	0	6
		0.00	0.00	33.33	0.00	33.33
		0.00	0.00	100.00	0.00	
		0.00	0.00	100.00	0.00	
Category 5		0	0	0	5	5
		0.00	0.00	0.00	27.78	27.78
		0.00	0.00	0.00	100.00	
		0.00	0.00	0.00	100.00	
TOTAL		2	5	6	5	18
		11.11	27.78	33.33	27.78	100.00

Percent of Agreement = 17/18 or 94.44%

Kappa Statistic = .922

Standard Deviation of Kappa = .0757

Z Score = 12.176

APPENDIX G-5

SURGICAL UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATING

NURSE EXPERT RATING	FREQUENCY / PERCENT / ROW PCT / COL PCT	Category 1	Category 2	Category 3	Category 4	Category 5	TOTAL
1		15	1	0	0	0	16
		28.85	1.92	0.00	0.00	0.00	30.77
		93.75	6.25	0.00	0.00	0.00	
Category		93.75	4.35	0.00	0.00	0.00	
2		1	21	2	0	0	24
		1.92	40.38	3.85	0.00	0.00	46.15
		4.17	87.50	8.33	0.00	0.00	
Category		6.25	91.30	18.18	0.00	0.00	
3		0	1	9	0	0	10
		0.00	1.92	17.31	0.00	0.00	19.23
		0.00	10.00	90.00	0.00	0.00	
Category		0.00	4.35	81.82	0.00	0.00	
4		0	0	0	1	1	2
		0.00	0.00	0.00	1.92	1.92	3.85
		0.00	0.00	0.00	50.00	50.00	
Category		0.00	0.00	0.00	100.00	100.00	
TOTAL		16	23	11	1	1	52
		30.77	44.23	21.15	1.92	1.92	100.00

Percent of Agreement = 46/52 or 88.46%

Kappa Statistic = .8846

Standard Deviation of Kappa = .067

Z Score = 12.287

APPENDIX G-6

MEDICAL UNITS AT SIX NAVAL HOSPITALS

CHARGE NURSES RATING

NURSE EXPERT RATING	Category 1	Category 2	Category 3	Category 4	TOTAL
1	15	6	0	0	21
	20.00	8.00	0.00	0.00	28.00
Category	71.43	28.57	0.00	0.00	
	93.75	16.22	0.00	0.00	
2	1	30	9	0	40
	1.33	40.00	12.00	0.00	53.33
Category	2.50	75.00	22.50	0.00	
	6.25	81.08	45.00	0.00	
3	0	1	11	1	13
	0.00	1.33	14.67	1.33	17.33
Category	0.00	7.69	84.62	7.69	
	0.00	2.70	55.00	50.00	
4	0	0	0	1	1
	0.00	0.00	0.00	1.33	1.33
Category	0.00	0.00	0.00	100.00	
	0.00	0.00	0.00	50.00	
TOTAL	16	37	20	2	75
	21.33	49.33	26.67	2.67	100.00

Percent of Agreement = 57/75 or 76%

Kappa Statistic = .619

Standard Deviation of Kappa = .078

Z Score = 7.920

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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nursing; management; hospital; care requirements; personnel; staffing; manpower utilization

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this study was to evaluate the validity and reliability of the Workload Management System for Nursing (WMSN) which includes a patient classification system and staffing methodology. In addition, the perceptions of registered nurses regarding the usefulness of the system as a management tool were measured using written questionnaires.

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At each of six study sites approximately 20% of the inpatient census (n = 229) was randomly selected from ICU, CCU, Pediatrics, Nursery, and Medical-Surgical units for reliability testing. Validity of the classification tool was determined by Army researchers using the Nursing Care Hours Standards (NCHS) tool which had content-related and criterion-related validity.

CONCLUSIONS: (1) The WMSN patient classification tool is valid (r = .81 with NCHS tool) and reliable (85% agreement) across six hospitals; (2) the tool reliably measures nursing care requirements across specialty units; (3) there is a high degree of reliability among most dimensions (factors) in the classification instrument; (4) nurses expressed greater satisfaction than dissatisfaction with the system; (5) charge nurses' perceptions of staffing adequacy and quality of care provided were significantly related to staffing; and (6) nurses' perceptions of direct and indirect care activities provided were significantly related to quantity and mix of staff available.

RECOMMENDATIONS: As a result of the study, recommendations were made for: ongoing validity and reliability assessments; extending computerization of the system to all hospitals; development of a mark-sense version of the patient classification tool; and extending the system to cover the measurement of patient care requirements in Labor and Delivery, Recovery Room, and Ambulatory Care.